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Notes on CHEMOSYNTHETIC COMMUNITIES

Michael K. Eagle

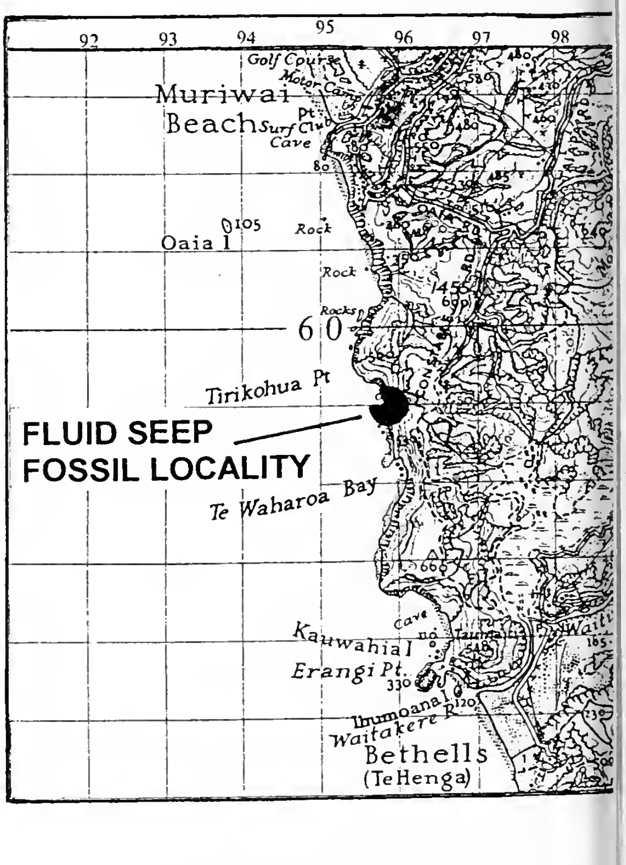
Hyrdothermal vent communities were first discovered in 1977 within a patch of seafloor about 50 meters in diameter, 2,500 m deep on the Galápagos Rift, some 380 km northwest of the Galápagos Islands, Pacific Ocean. The discovery of previously unknown colonies of marine macrofauna adapted to living in elevated temperatures, high pressure, and 'clouds' of hydrogen sulphide naturally prompted much research. Initial studies centred on the origin and concentration of life at hydrothermal vents asking such questions as: how did large organisms exist there, did the characteristics of each community represent successional stages or were they discrete biological islands resulting from chance immigration across large expanses of seafloor, and were marine organisms settling in response to different chemical gradients at each occurrence or were communities simply haphazard and serendipity? Both biological (physiological and ecological) and geological (environmental) programs by a number of marine research facilities using deep-sea submersibles (e.g. 'Alvin' - Woods Hole Oceanographic Institute, U.S.A) were subsequently undertaken both in the Atlantic and Pacific Oceans, charting vents, hot-spots, mid-ocean spreading ridges, and their thermophilic (heat-seeking animal) residents (see: Gebruk *et al.* 2000).

Much literature has appeared since 1977, elucidating upon community structures, describing new species, and generally investigating the narrow biogeographic distribution of such faunas. Many species and genera remain to be discovered. Still relatively unknown are the migration pathways of larvae settling at vents or ridges, their lifecycles, and dispersal mechanisms. Collectively known as 'vent' faunas, cold (e.g. methane seeps) and thermal micro-organisms existing on surfaces, below the seafloor, in the water column, and in association with other organisms remains an important frontier pertinent to the consideration of extreme life-forms different from our own metabolic make-up. Recent templates are emerging for vent and spreading-ridge processes controlling the evolution of 'extremeophile' faunas, but the cycle of origination and cessation of individual 'vents' and 'vent fields', either as cold methane seeps or mid-ocean ridge thermal occurrences, is still not well understood. However, by continuously and simultaneously observing the biological, geological, chemical, and physical processes occurring at these sites, we learn how all these process interact. Because many of the animals of these communities host commensul bacteria that help feed them in such extreme biotopes, they are called chemosynthetic. Chemosynthetic communities are also found fossil, usually identified by an assemblage of ecologically similar constituents (e.g. bivalves B*athymodiolus* and *Calyptogena*, ventimentiferan tubeworm *Riftia*, surpulid polychaete *Laminatubus*, and gastropod *Alvinconcha*). Seep faunas have been recorded from New Zealand (e.g. Lewis & Marshal 1996), and Plio-Pliestocene seep mussels recorded from Hawke Bay (Mike Collins 1998 - Auckland University unpublished MSc thesis). Perhaps the greatest legacy of hydrothermal vent studies has been the collaboration of scientists from many disciplines, including zoology, oceanography, geology, and paleontology to learn how a previously unknown ecosystem functions.

Since the initial 1977 discovery of vent-type faunas many questions have been addressed regarding how animals can thrive in scolding, toxic water or (to us) suffocating clouds of sulphur or pressurised methane flows. Food provision, metabolic rates, dispersal mechanisms and distribution patterns are now

fundamentally known. Microbes oxidise geothermally produced sulphur compounds (principally hydrogen sulphide), thereby providing energy for dense communities of animals either surrounding isolated volcanic or spreading ridge hydrothermal vents. Within the parameters of such sulphur-rich flowing seawater self-sustaining microbial 'mats' of motile hydrogen sulphide-oxidising bacterium grow and excrete large amounts of flocculant, filaments of elemental sulphur. Initially, filaments are produced by a single bacterium, but others progressively attach as colonisation continues. Filaments grow incrementally as additional members of the species attach and contribute to the total product. Animals living within such microbial mats host different bacteria that assimilate sulphur, producing sugars and proteins to sustain the host.

Recent research indicates present-day hot-vent faunal distribution to be a product of historical dispersal. The concept of vicariance is important in biogeography, particularly in the interpretation of organism patterns with respect to the formation and disappearance of range barriers. Fossil communities of chemosynthetic molluscs similar to those now living around modern hydrothermal vents and cold-seeps have, like recent occurrences, now been recognised globally. Marine sedimentary deposits containing ancient cold-seeps have been described from Europe, Western United States, Japan, and Canadian Arctic (e.g. Goedert and Campbell 1995). However, many taxa from these fossil sites are poorly preserved and cannot be identified, so that reports centre on stratigraphic, petrographic, and isotopic data, with faunas only briefly mentioned. Of local interest is an early Miocene (Altonian Stage) submarine canyon complex incorporating the Otakimiro Member, Tirikohua Formation (see: Hayward 1976a, 1976b, 1979, 1983) located at Te Waharoa Bay (some distance south of Maori Bay, Muriwai – between Muriwai and Piha), Motutara Coast, West Auckland (Fig. 1). At the base of several of these canyons (one in particular), are the displaced remains of a rich, distinctive fluid seep (vent) chemosynthetic fauna, that lived independent of the photosynthesis-based (carbon) food chain generally operating now and in the oceans at that time. However, the animals (although diagnostic in faunal association and composed of known chemosynthetic genera), is not part of a methane-rich dewatering mechanism operating as a result of over-pressured sediments, such as that found on a convergent margin, nor is it a cold-seep vent (as those found offshore in Hawke Bay) or mid-ocean ridge assemblage (like the mid-Atlantic), but the fossil remains of a volcanic vent community living at 1200-1500 m depth on the submarine slopes of the prehistoric Waitakere Volcano (Fig. 2). Since the faunal assemblage is not *in-situ*, no chimneys or heavy mineralised crusts have been found in association. Apparently, the down-slope gravity flow of erupted ash and clastic material (perhaps a



Fig, 1. Map showing the Motutara fluid seep fossil locality.

succession of submarine lahars) carried deep-water marine invertebrate elements of a thriving community, into the canyon. Distance travelled cannot have been far, and the transport relatively gentle, as many bivalves including large lucinids , smaller

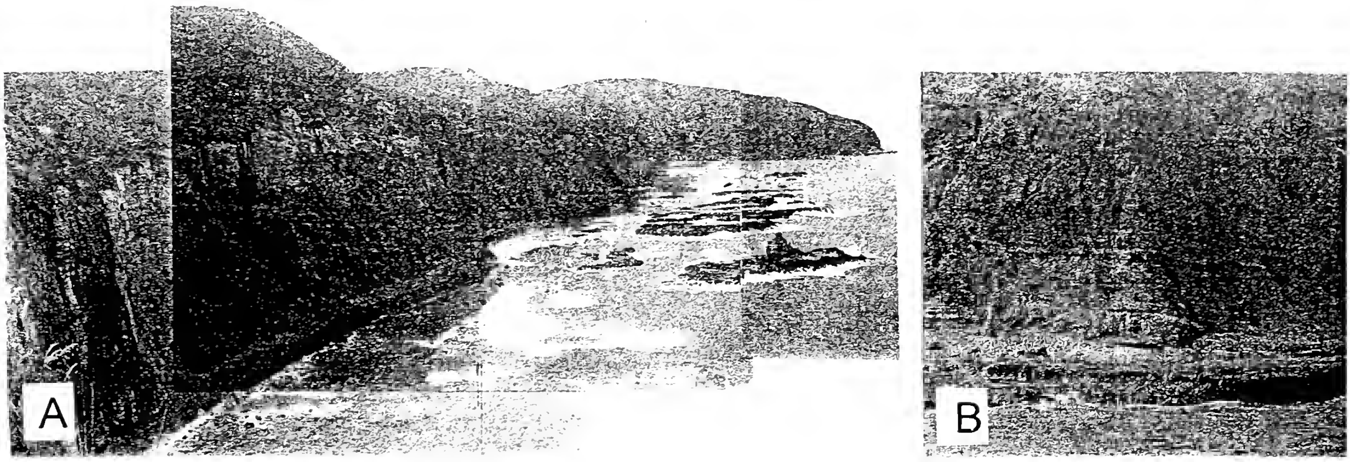


Fig. 2. A. Photograph composite of the Te Waharoa Bay coastline from Tirikohua Point. The fossil locality is about mid-coastline. B. Site of the fluid seep fossil exposure, Te Waharoa Bay, Motutara.

mytilids, and vesicomyids (Fig. 3) possess valves still conjoined. Unbroken worm tubes are also present in colonial numbers, and the assemblage is complimented by the occasional gastropod. The lucinid was originally described (Eagle 1992) from a different fossil locality without knowing either the extent of or significance of the assemblage. The small allochthonous, diverse, localised fossil chemosynthetic assemblage is entombed in an unusual diagenetically altered volcarenite that is black, recrystallised, and well consolidated. Molluscan shells there are minerally replaced; calcium carbonate has changed to calcite, and in thick shells, this preservation can appear visually stunning. Fossil taxa from this site have yet to be described.

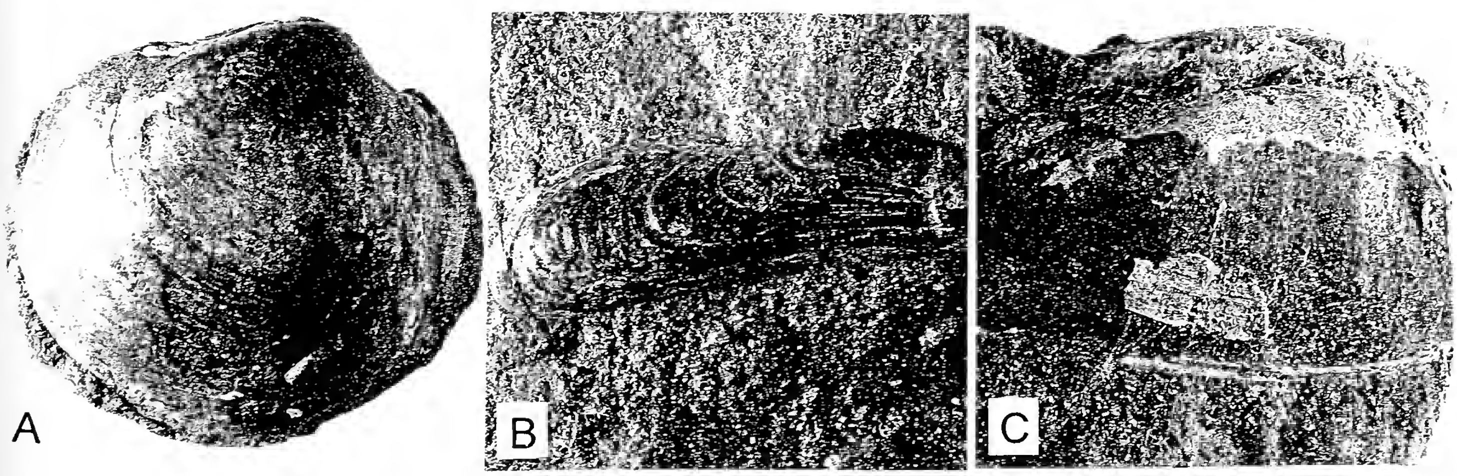


Fig. 3. A. Large lucinid (*Anadonta waharoaensis*), B. mytilid (*Bathymodiolus* n. sp.), and C. vesicomyid (*Calyptogena* n. sp.) from the early Miocene Te Waharoa Bay fluid seep fossil locality.

The taxonomic status of many chemosynthetic species is constantly being revised. Biological collections have the added advantage of genetic characters in addition to the morphological characters of 'chemoautotrophic' fossils. However, as recent and fossil chemosynthetic assemblages are discovered and studied our present knowledge of a high diversity of biotopes, including black smokers, smoking craters, diffuse flow areas, bacterial mats, mussel beds and heavy metal sediment gardens will increase. Trophic analysis of these biotopes will provide valuable ecological models for possible use in identifying life elsewhere in the universe where chemosynthesis is viable and may predominate.

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The Mt. Wellington Lava Fields - Gone Forever

Bruce F.Hazelwood

The Mt. Wellington Lava Fields was an area strewn with lava rock and scoria which was flung in all directions from Mt. Wellington - Maungarae, Auckland, when the mountain errupted, (approx. 9000 years ago. The field extended south - west of the mountain, nearing the Manukau Harbour then northwest through Penrose, and as far north as Abbotts Way, Ellerslie. The main lava flow spilled into a deep basin - to the north of the mountain, this is what was the Mt. Wellington Quarry.

It is estimated that 8.5 million cubic meters of lava were extruded from the mountain. Some locations comprised of lava rock in dense concentrations, native vegetation eventually colonized this inhospitable environment became established. By the early 19th Century, these refugia were lush containing a fauna of both arthropoda and snails.

Snails were collected by Henry Suter and Musson between 1890 and 1913, the exact locations not recorded.

Many Scientists and Prominent Conchologists collected here.

Two species of landsnails were described from the Mt. Wellington Lava Fields.
Phenacohelix ponsonbyi (Suter,1897)
Laoma (Phrixgnathus) moellendorffi Suter,1896
Type Locality - Mt. Wellington Lava Fields

Due to industrialisation and housing this specialised habitat had reduced considerably by 1980, few sites remained. However one site survived near the Fulton Hogan Yards (at the end of Leonard Road, Mt. Wellington). This site was a large rock pile covered by some trees, mostly privet. An oasis, which was adjoined by a rocky (lava) wilderness covered with both native and introduced vegetation, eg. toetoe (***Cortaderia fulvida***), privit and Australian wattle.

Jim Goulstone and Norm Gardner collected near here under high-tension power lines and close to the lava caves, - toetoe / lava rocks piles.

I (B.F.H.) also collected under the power lines just off Gavin Street, opposite the Penrose sub station. Under privet - bases of lava rocks (beside power pylons) and mostly from the substantial lava rock heap at the end of Leonard Road.

Unpublished report - J.F. Goulstone 1977

Native landsnails from the Hunua Range and Several Locations in South Auckland

"Mt. Wellington

An area extensively collected in Suter's day has almost disappeared under factories and houses. A small area underneath hightension power lines adjacent to the Penrose substation remains fairly undisturbed and still supports a good range of species under a tumbled mass of rocks. However none are plentiful and encroaching pressures here are so great that this colony cannot last!

Phrixgnathus sublucida - Phrixgnathus Nsp (cf lucidus) is a species found here which I (J.F.G.) have not found elsewhere"

Subsequently ***Phrix Nsp (cf lucidus)*** was collected by Jim from Mt.William Walkway - Bombay Hills and Coromandel Penninsula - collected by Norman Douglas. A closely "related form" is present in the northern region of Great Barrier Island, (J.F.G.). unpublished.

When specimens were rechecked, some of the ***Phenacohelix giveni*** were found to be ***Phenacohelix ponsonbyi***. (Pers.Com. - Jim Goulstone)

Both Phenacohelix ponsonbyi and ***Laoma (Prix.) moellendorffi*** were found at Jims and my (B.F.H.) localities.

Goulstone J.F. 2001
A Revision of the Genus *Phenacohelix* Suter, 1892 (Mollusca : Pulmonata) with Descriptions of Four New Species and Reassignment of *Thalassohelix ziczac*
(Gould, 1846 Rec. Auck. Mus. 38 :39 -82

"*Phenacohelix ponsonbyi*
The type locality of *Phenacohelix ponsonbyi* is the Mt. Wellington lava fields, Auckland. The type locality has been virtually lost to urbanisation, with the area covered in houses and factories. No forest cover remains. At the time of writing (August 1998),B.F.Hazelwood could find only one empty ***P. ponsonbyi*** shell at R11/726758, where 20 years ago the species was still abundant. This is to be developed as a quarry but is presently covered with exotic weeds and litter".

These sites were destroyed to make way for the Fulton Hogan Quarry.

A buffer zone still remains intact

Sampling of the buffer zone,behind houses on Eaglehurst Street needs attention.

Are any insects or snails still living there?

It is interesting when comparing all available sites and Suters list, that this is only a poor indication of the total species that once inhabited this area.

The difference between Jims and my (B.F.H.) sites even though only a few hundred metres apart is dramatic. Sometimes a few metres separation can turn up a different combination of species.

Four plastic bags of litter from under rock heaps, still await attention at the Museum of New Zealand, Te Papa Tongarewa,Wellington.

It is interesting to note the emergence of ***Punctid nsp (aff ariel)***
(Sp 2000: Punctid nsp 140) at both localities and within the Mt.Wellington crater since Jim Goulstone collected in the area.

Suters ***Laoma glabriuscula*** could be this species? or ***Punctid (nsp 59)***

Species Present (J.F.G.)

Cytora cytora	1	
Liarea egea egea	2	
Tornatellinops novoseelandica	2	
Delos sp	1	
Charopa coma	1	
Mocella eta (non Reeve,1852)	4	*Subfectola caputspinulae*
Climocella akarana	2	*Mocella eta* (non Pfeiffer,1853)
Huonodon pseudoleioda	1	*Ptychodon pseudoleioda*
Therasiella celinde	1	
Suteria ide	3	
Phenacohelix giveni	20	
Phenacohelix pilula	1	
Phenacohelix ponsonbyi	5	
Laoma leimonias	2	
Phrixgnathus erigone	2	
Phrixgnathus moellendorffi	2	
Phrixgnathus nsp (aff lucidus)	4	
Phrixgnathus "transitans"	2	*Punctid nsp (aff poecilosticta)*
Paralaoma lateumbilicata	1	

Leonard Road Locality (B.F.H.) 1/8/1998

Punctid nsp (aff ariel)	3	
Phenacohelix giveni	10	
Phenacohelix ponsonbyi	1	
Flammulina perdita	5	
Phrixgnathus moellendorffi	19	
Paralaoma caputspinulae	1	*Paralaoma pumila*
Taguahelix crispata	6	
Phrixgnathus fulguratus	1	
Phrixgnathus conella	12	
Punctid nsp 23	1	
Charopa coma	2	
Mocella eta	?	

Cavellia buccinella	?
Delos sp.	1

Intrduced Species

Cantareus aspersus
Cochlicopa lubrica
Oxychilus alliarius
Oxychilus cellarius
Lauria cylindracea

Located in the crater of Mt. Wellington (B.F.H.)

Punctid nsp (aff ariel)
Climocella sp.
Paralaoma caputspinulae

Species list Contained in the Manual of the New Zealand Mollusca - Henry Suter

The Mt. Wellington Lava Fields

Modern usage	**Suter's List**
Therasiella celinde	*Therasiella celinde*
Therasiella tamora	*Therasiella tamora*
Charopa parva	*Charopa pilsbryi*
Fectola infecta	*Endodonta (Thaumatadon) tau*
Huonodon hectori	*Endodonta (Ptychodon) hectori*
Phenacharopa pseudanguicula	*Endodonta (Charopa) anguiculus*
Cavellia buccinella	*Endodonta (group 3) buccinella*
Climocella sp.	*Endodonta (group 4) corniculum f albina*
Geminoropa Nsp (aff cookiana)	*Endodonta (group 5) microrhina*
Phenacohelix giveni	*Phenacohelix ponsonbyi*
Phenacohelix ponsonbyi	*Phenacohelix ponsonbyi*
Laoma marina	*Laoma marina*
Phrixgnathus conella	*Laoma conella*
Phrixgnathus erigone	*Laoma erigone*
Phrixgnathus Nsp 59?	*Laoma glabriuscula*
Phrixgnathus moellendorffi	*Laoma moellendorffi*
Paralaoma lateumbilicata	*Laoma lateumbilicata*
Paralaoma caputspinulae	*Laoma pumila*

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Mt Wellington Lava Feilds	Suter	Goulstone	Hazelwood
Cytora cytora		+	
Liarea egea egea		+	
Tornatellinops novoseelandica		+	
Charopa coma		+	+
Mocella eta		+	+
Climocella akarana	+	+	
Huonodon hectori	+		
Huonodon pseudoleioda		+	
Fectola infecta	+		
Charopa parva	+		
Phenacharopa pseudanguicula	+		
Geminoropa nsp (aff cookiana)	+		
Cavellia buccinella	+		+
Therasiella celinde	+	+	
Therasiella tamora	+		
Suteria ide		+	
Phenacohelix giveni	+	+	+
Phenacohelix pilula		+	
Phenacohelix ponsonbyi	+	+	+
Flammulina perdita			+
Laoma leimonias		+	
Laoma marina	+		
Phrixgnathus erigone	+	+	
Phrixgnathus conella	+		+
Phrixgnathus fulguratus			+
Phrixgnathus moellendorffi	+	+	+
Phrx. nsp (aff lucidus)		+	
Phrix. nsp ("transitans")		+	
Phrix. nsp (aff ariel)			+
Taguahelix crispata			+
Paralaoma caputspinulae	+		+
Paralaoma lateumbilicata	+	+	
Punctid nsp 23			+
Punctid nsp 59	+		
Delos sp		+	+
Cantareus aspersus			+
Oxychilus alliarius			+
Oxychilus cellarius			+
Lauria cylindracea			+

COMBING THE COAST

By Bev Elliott

It was Feb. 21st 1996, and I had an appointment with the Employment Adviser. What a waste of time! One had to go through the outward appearance of job seeking, but everyone knew there weren't any jobs, especially for a lady in her mid 50's. There was even a day when I called into the Kaikoura Employment Office seeking some extra voluntary work, and they did not have even one job, paid or voluntary, to offer to anyone. But on this day Noel was pleasant to talk with; she asked me about my hobbies, and I told her of tramping, shells, photography, bird-watching and beachcombing. I told her of my involvement with Seacare, taking part in the rescue of seals entangled with mans' rubbish, and picking up rubbish on the beaches. That sparked an idea. She would discuss with Seacare and DoC the possibility of a beach cleaning job for me.

The weeks went by, and I had dismissed my job to the realms of wishful thinking, and then suddenly, at the end of March, I was employed, 6 hours per day, 3 days per week, at $1 per hour! Eleven weeks went by, and the beaches were somewhat cleaner, but the increase in my Bank Balance was NIL, and I expressed my indignation at the unfairness of this! How easy, in these days of modern technology, to blame the Computer and/or headquarters far away in the North Island. At last, one lump sum of back payment came my way, along with the comment, "There's no more money; it was only a 3 month job anyway!" They hadn't told me that before. Isn't it strange how there's plenty of money to pay people to do nothing, but no money to pay people to do something useful! So I was unemployed again.

But I very soon decided that having done all that hard work, I was not going to sit back and let the beaches revert back to the disgusting mess there'd been when I started. And it would be much more pleasant to do it when I pleased, instead of being tied down to having to do it. So I continued happily onwards, extending my territory to 26 kilometers, from Kowhai Mouth (south of Kaikoura) to Hapuku (north of Kaikoura), which I did every 2 months, while the 12 k's of more populated area around South Bay, Kaikoura Peninsula and the township I cleaned monthly. I had been doing this about 18 months, when I had an unpleasant encounter with an irate young man, one of a group employed to empty rubbish bins. He did not appreciate my work one little bit! And for 2½ weeks it looked as though I was going to be workless again, as the Council, to appease their rubbish bin emptiers, brought in a law that no beach rubbish was to be put in rubbish bins. Our Seacare leader plunged into the fray with unstoppable determination, DoC came in on my side, the Council backed down, and at last I was off and away again.

Several years later, with an amazing change of heart, the Council presented me with a Community Services Medal for my work. But that's another story --- for the moment, I was merely tolerated.

I was walking 26 km of coastline on a regular basis. In Sept 1997, on a trip to Cape Campbell, I walked down the coast to Boo Boo Stream, and had the satisfaction of knowing that, over the years, I had walked 55 consecutive km of coastline, from Ure River to Wairau Lagoon. I had also walked from Big Bush Gully to Waiau Mouth in Sept 1993. (That trip, with its haul of well over 100 Chlamys gemmulata, was reported in Poirieria Vol 17 No 1 May 1994.)

The several kilometers from Oaro to Claverly, around the beautiful and fascinating Amuri Bluff, were often on our Tramping Group programme, and occasionally the Gore Bay to Hurunui Walkway was too. And I had explored the Motunau area for fossils. I began to wonder how far north and how far south one could walk along the coastline.

The Marlborough Sounds would be impossibly difficult. So I started at Monkey Bay, north of Blenheim, in July 1998, and walked along Rarangi Beach to Wairau Mouth. Then I got permission to cross private land to the Wairau Bar, and walked along to the south side of Wairau Mouth. I put several long beach walks on the Tramping Group programme, and began filling in the gaps from Ure to Clarence to Hapuku (north of Kaikoura), and Kahutara to Oaro (south of Kaikoura). Gore Bay to Waiau

Mouth went on the programme, and in Oct. 1998, four eager trampers set off, little dreaming of the obstacles that lay ahead. Steep cliffs, jagged rocks and an exploding population of seals, which included two for three that were prepared to defend their beach against the human invaders! I found myself alone, facing a very determined seal, while my trusty companions were scaling the nearby cliff with surprising agility! It was time to give up, as the tide was almost low, and we were only a quarter of the way. If one could have low tide all the way, it would be okay, but on a trip that was going to take five hours each way, high tide had to come into it somewhere.

It wasn't until my fifth try that I actually completed it, by starting before daylight, shortly before high tide, and I just kept going, no matter what. I had to be prepared to get wet, and to go up and over if I really couldn't go around, and I refused to be intimidated by any seal that thought I shouldn't be there. Seals are very seldom aggressive, but the sheer numbers in this area are rather daunting. I was told that a few years ago there were 30 to 40; now (March 2000) there are 3000 to 4000, with 100s of young ones coming on. It was great to watch the baby seals frolicking in a big pool at low tide, and then further north a lovely waterfall comes over the cliff into the sea, with lots of young seals sitting on the rocks around it. The high tidal difficulties faced in the morning were all gone by midday, and with the tide out, the return trip was so much easier.

Nape Nape to Motunau was going to be a difficult piece of coastline. I called at Stonyhurst, halfway between the two, and was refused permission even to walk across the paddock to see what the coast was like. I said that "You can't stop me walking along the coast – you can only make my walk a whole lot more difficult and risky." With access through Stonyhurst denied, that part of the walk had to be divided in two. Up the coast from Motunau proved to be mostly easy after all, a long sandy beach that I walked in March 1999. I encountered a Yellow Eyed Penguin, moulting there. The sandy beach ended abruptly with a very difficult point near Black Birch Stream. At low tide the water was knee deep as I paddled around, and I had to get back within an hour before the tide started rising. A little further north I found the remains of the steamer "Kaiwarra", wrecked there in 1942. What an inhospitable place to be shipwrecked! Her crew of 45 were all rescued, but not until 3 days later, and it must have been a very anxious time of waiting.

In April 1999, a month later, I was on my way back to the "Kaiwarra", this time from the north. This piece of coastline was the most amazing of all, with fantastic cliffs and spires of white limestone. It was also the most difficult, quite impossible in places, making it necessary to retreat to the cliff tops. The scenery was even more spectacular along the beach at low tide on the way back.

South of Motunau was going to be too difficult, and for a while I was satisfied with having completed Blenheim to Motunau, 230 kilometers. But Blenheim to Christchurch would sound so much more impressive. Maybe the long sandy beaches from Waipara south to Christchurch wouldn't be as boring as I thought. And maybe the rocky coast north of Waipara wouldn't be as impossible as I thought. In Oct. 1999 Olive Boyd and I had a scenic coastal flight from Kaikoura to Waipara, an 80th Birthday present for her, and for me a wonderful opportunity to see from the air the places I'd walked, and also the places I hadn't walked, some of which looked very formidable. Much time was spent later, poring over the photos we'd taken.

In Nov. 1999 an operation on my foot put me out of action for a while, but at Easter 2000 I contacted Ross Little at Mt Vulcan, south of Motunau. What a contrast – he couldn't have been more obliging, and with his advice and assistance, I walked the long length of rocky and very isolated coastline from Motunau to Montserrat to Glen Afric. Although Motunau and Glen Afric are both interesting fossil areas, it was disappointing to find between them a long stretch of nothing much.

In June 2000, looking for easy tramps to do in the winter, I started on the long sandy beaches north of Christchurch, and finished them in October, a little here and a little there, not in consecutive order. The southernmost piece, from New Brighton Pier to Heathcote/Avon Estuary, was done on a brilliant

August day, and it was a great thrill to reach the end of the 300 kilometer tramp, even though there were still some parts further north to do. 18 little Wrybills were there to greet me, as well as flocks of Oystercatchers and Gulls.

At this stage, August/September 2000, I was ready to tackle the next part of the difficult rocky coast, from Glen Afric to Waipara. Each time the tides were right, the weather was not. The rain came down in bucketfuls, and the wind blew gales! On Oct. 11th I drove to my destination at Waipara, determined to wait until the weather improved. And wait I certainly did, right through the notorious Oct.12th storm that did so much damage to Christchurch and Banks Peninsula. By Oct. 14th the weather was fine, and I set off down the coast from Glen Afric to see if I could get south to Waipara. But once the sandy beach ended, the rocky coast was so rough that I had to seek a way on to the cliff top --- and once I got on the cliff top, there were some great views of the coast down below, but no way of getting down to it. I covered a long way that day, and could see my goal in the distance, but it was too far, and the going through Waipara Pine Forest was too tough, and there was still no way down to the beach. This time I returned with a heavy bag of fossils. Eucrassatella ampla shells, Cucullaea inarata Ark Shell, Tumidocarcinus giganteus Crabs and Flabellum coral.

The last few kilometers of coastline would have to be tackled from the Waipara end. And I knew it would be rough, as I'd tried it some years before, and found it far too difficult. But this time so much was at stake – I was going to complete Blenheim to Christchurch no matter what. So I just kept on scrambling over huge rocks, on and on, until at last I rounded a corner on to the sandy beach I'd photoed from the cliff top a month earlier. I'VE DONE IT!!! And at the same moment I saw a metre thick band of Eucrassatella ampla along the bottom of the cliff, and there were other fossils further along, and a nesting colony of Black Backed Gulls on the beach, and Spotted Shags nesting on the cliffs above - oh, the excitement of trying to collect fossils, and observe the birds, and take photos, and explore further while the tide was low, while being very careful to watch the time, and retreat before the tide started to rise.

This was Nov. 2000, and in Dec. 2000 I was back there again, this time with 9 companions. What a grand day out for this group of Creation Science supporters, and some heavy loads of fossils were carried out that day. The Spotted Shags, however, were not enjoying life at all. Many of the growing chicks had fallen out of their nests and tumbled down the cliff, with very high mortality. Some had survived, and were waiting in the hot sun for their parents to come back and feed them. In March 2001 I returned for one more visit, to try to link up with where I had come south from Glen Afric. Along Crassatella Beach, around Terrible Point (which isn't terrible at all, at low tide), along Spire Beach with its 2 spectacular rocky spires - just one short piece to go, but time was running out, and the going was getting rougher with huge steep rocks, and the cliffs unclimbable. So I'll have to be content with having done that piece along the cliff top back in October. Some of the Spotted Shags had survived the tumble down the cliff and all the other dangers of life, and one of my photos shows over 50 young adult shags on a big rock at Spire Beach.

Things found on beaches:

Vast amounts of Polystyrene and huge sheets of plastic. Back in the 90s, workmen littered Construction areas and the nearby coastline indiscriminately. There has been a tremendous improvement in environmental consciousness since then.

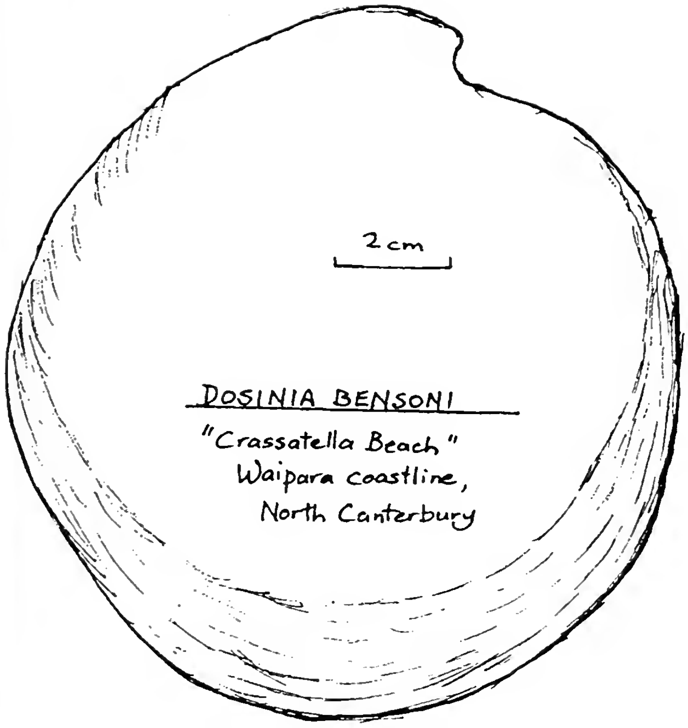
The same applies to fishermen, who no longer discard all their rubbish into the sea. Storms, of course, still wash floats, ropes, nets, etc ashore.

Blue plastic strapping is a hazard to our seals, some of which have been horribly choked to death. Seacare members rescued a number of these before it was too late. Once the offending plastic or rope is removed, seals can fully recover from horrendous injuries.

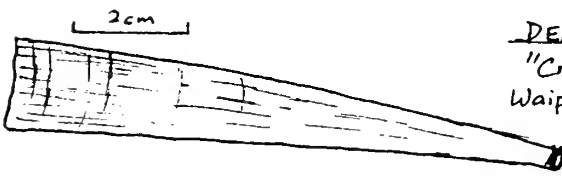
Drink bottles and cans by the hundreds.

My 2 pet hates: Glass bottles deliberately smashed and disposable nappies!
Useful items of clothing and footwear; even a lovely white blouse that I have often worn to church.
Snorkels, facemasks and flippers, often still useable, and a life jacket that one friend was very pleased to get.
Enough towels and hankies and socks to last me for the rest of my life.
Camping equipment, tent bag, tent pegs, ground sheets, parka, mittens and woolly hats.
Numerous Golf balls, which I give to my neighbour, and tease him about being able to hit them so far, as the Golf Course is quite a distance from the beach.
Some folk have even left their holiday films or cameras on the beach. One Camera (after the required 2 months at the Police Station) took the most beautiful wide-angle photos - but only for one film, and then it went dead.
Shells: more for shellwork than for the collection. But in 2000 and 2001 I found 6 Paper Nautilus, the only ones I've found in 50 years of shell collecting.
Dead birds are recorded for Ornithological Society Beach Patrols. Huttons shearwaters are common, also spotted shags, occasional sooty shearwaters, blue penguins, white-flippered penguins, fairy prions, broad-billed prions, wandering albatross, giant petrels, mollymawks, cape pigeons, westland black petrels, diving petrels, antarctic fulmar (one), grey backed storm petrel (one). Among many live bird species are three rare penguins: yellow eyed, erect crested, and a single very healthy adelie, maybe the only record for new zealand.
A dead Sperm Whale. Part of a dead Giant Squid. 2 dead Giant Sunfish, both in excellent condition.
Occasional dead sharks and dolphins. Dead Basking Sharks: These monstrous creatures have a strange way of decaying. When they are about half rotted away, they have a long neck with a small head, and a long tail, and somewhat resemble a plesiosaur. It was one of these that gave rise to the myth that Japanese fishermen netted a dead plesiosaur off the east coast of the South Island in the 1970s. Fur seals by the thousands. One living Hookers sea lion. Occasional living sea leopards and sea elephants. Sea elephants are almost always juveniles. It is many years since I've seen a big adult male with his bulbous nose.
And the Fossils! Only a few places along the coast have fossils: Amuri Bluff (lots of Belemnites and a few bits of plesiosaur bone), Big Bush Gully (a good selection of shells), south of Nape Nape (Cirsotrema lyrata), Motunau, Glen Afric, and the coastline north of Waipara. A partial list from north of Waipara:

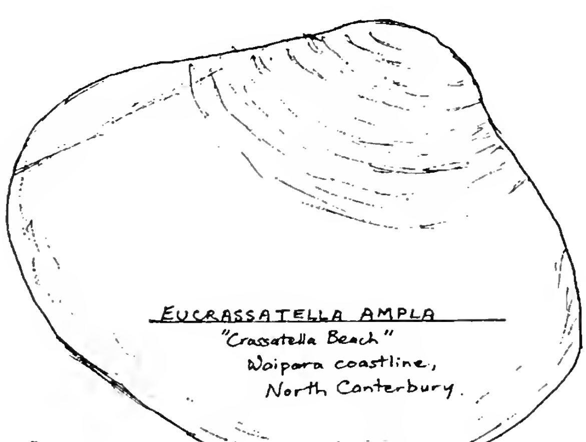
Dosinia bensoni (huge), Dosinia greyi, Glycymeris (8cm)
Cyclomactra ovata, Bassina yatei, Eucrassatella ampla (huge)
Maoricardium (huge, but only pieces), Panopea, various Pectens
Oysters (huge!) the hinge alone is 10cm, and the best one was too heavy to carry.
Large Dentalium (lots), Cominella and other whelks, Alcithoe
Struthiolaria spinosa, Zelandiella (close to Austrofusus but smaller & rounder)
Many Polinices Moon Shells, Tudicula (one), Maoricrypta radiata
Ataxocerithium suteri, Austrotoma obsoleta, Terebra Zeacuminia orycta
Baryspira novaezelandiae, Baryspira subhebera,
Larger olives similar to Oliva australis.
From Glen Afric: Cucullaea inarata (huge Ark Shell), Flabellum coral,
Giant Turritella (10cm), Pectens (like Pallium convexum, but bigger),
Tumidocarcinus giganteus (the Giant Crabs for which Glen Afric is famous, but I only found a few scrappy bits and pieces),
Eucrassatella ampla, large Cardium.



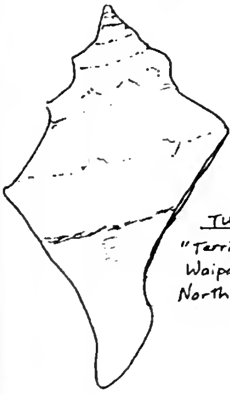
DOSINIA BENSONI
"Crassatella Beach"
Waipara coastline,
North Canterbury



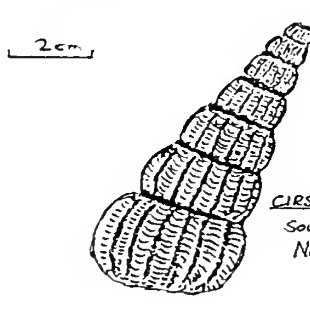
DENTALIUM
"Crassatella Beach"
Waipara coastline,
North Canterbury.



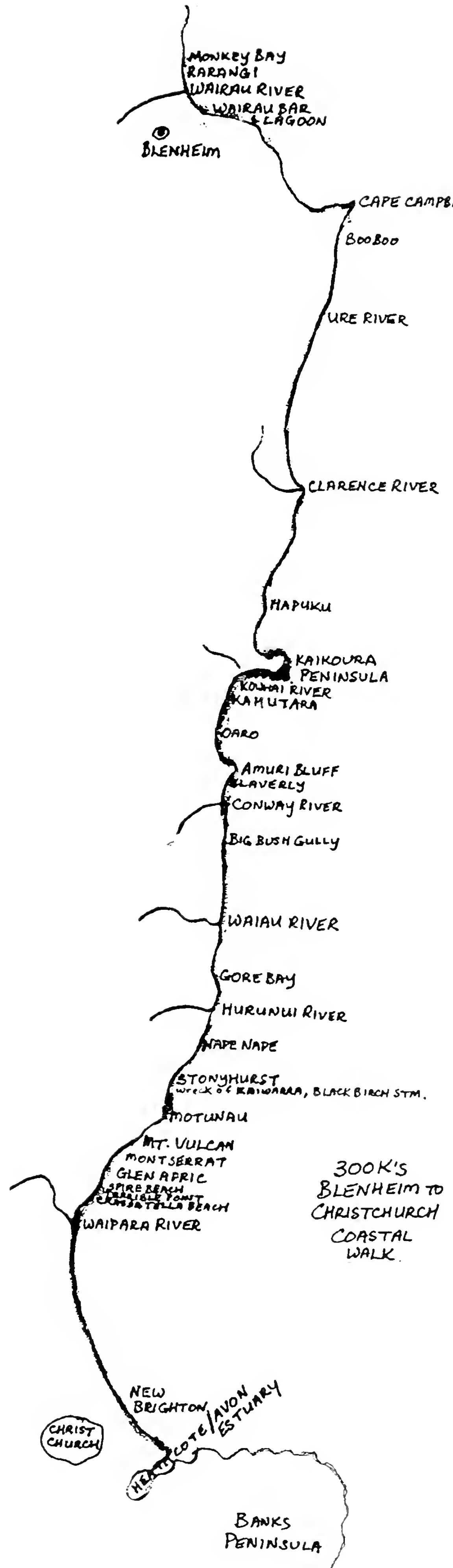
EUCRASSATELLA AMPLA
"Crassatella Beach"
Waipara coastline,
North Canterbury.



TUDICULA
"Terrible Point"
Waipara coastline,
North Canterbury.



CIRSOTREMA LYRATA
South of Nape Nape,
North Canterbury.



The Australasian Genus *Eudoxochiton*: (Mollusca - Polyplacophora: Callochitonidae)

Bruce Hazelwood

The Genus *Eudoxochiton* is represented by two species, *Eudoxochiton nobilis* (Gray, 1843) from New Zealand and and the Kermadec Islands. The other *Eudoxochiton (Eudoxoplax) inornatus* (Tenison-Woods, 1881) from Tasmania, South Australia and Victoria. Both species posses shell eyes, as do all species within the *Callochitonidae*.

Genus *Eudoxochiton* Shuttleworth, 1853 *E.nobilis* - intertidal-subtidal

Subgenus *Eudoxoplax* Iredale& May,1916 *E.(E.) inornatus* - subtidal

Kaas and Van Belle (1985) illustrate a juvenile specimen of *E. nobilis*. (Page 71), which at first glance appears to be a new species of *Callochiton*.

The girdle eliments in this juvenile differ from the adult, having a pattern of closely fitting spicules instead of a leathery girdle. This state closely resembles that in *Callochiton*. The validity of the subgenus *Eudxoplax* Iredale & May, 1916 is in serious jepody. *Eudoxochiton* Shuttleworth, 1853 tentatively stands as being distinct from *Callochiton S.S.* The dominent insertion plates at the end of the valves in *Eudoxochiton* are significant, however, some form of insertion plate can be present in other species of *Callochiton*. It appears that only size, leathery girdle and spikes separate *Eudoxochiton* from *Callochiton*, juvenile girdle elements of *E. nobilis* closely equate with that of *Callochiton* Gray,1847

Conclusions

1) It would be interesting to see a juvenile specimen of *E.(E). inornatus*

E.(E) inornatus girdle elements are midway between *Eudoxochiton* and *Callochiton*.

2) There are two species in *Eudoxochiton*!

3) Is *Eudoxoplax* a synonym of *Eudoxochiton*?

4) Is *Eudoxochiton* Shuttleworth, 1853; a sub-genus of *Callochiton* Gray, 1847

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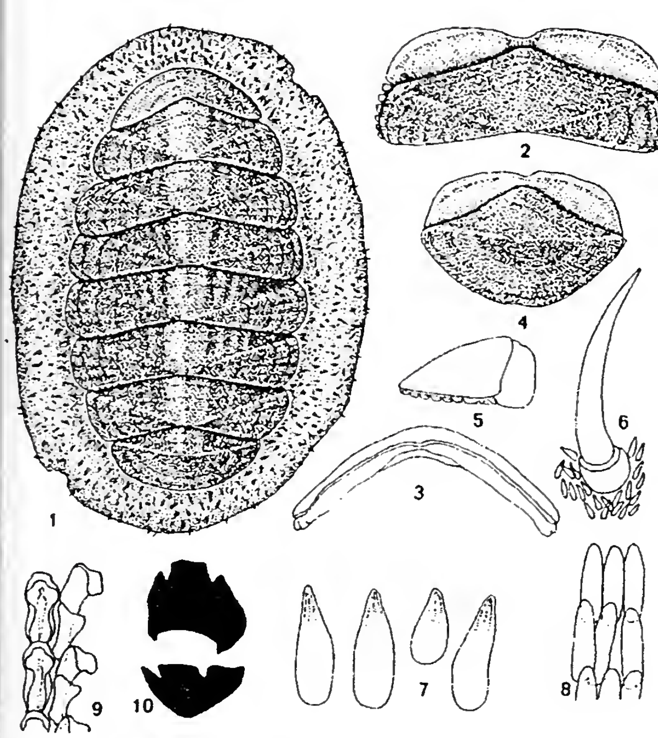

Fig. 32. *Eudoxochiton (E.) nobilis* (Gray).

1, whole specimen, dorsal view, ×1.6; 2, valve IV, dorsal view, ×1.6; 3, do, anterior view, ×1.6; 4, valve VIII, dorsal view, ×1.6; 5, do, lateral view, ×1.6; 6, dorsal spicules and chitinous bristle, in situ, ×40; 7, isolated dorsal spicules, ×200; 8, ventral scales, ×200; 9, central and first lateral radula teeth, ×50; 10, heads of major lateral teeth, ×50.

1, specimen from New Zealand, B.J. Weeding don., K 2400; 2-10, specimen from Stewart Id, New Zealand, Penniket leg., VB 2517a.

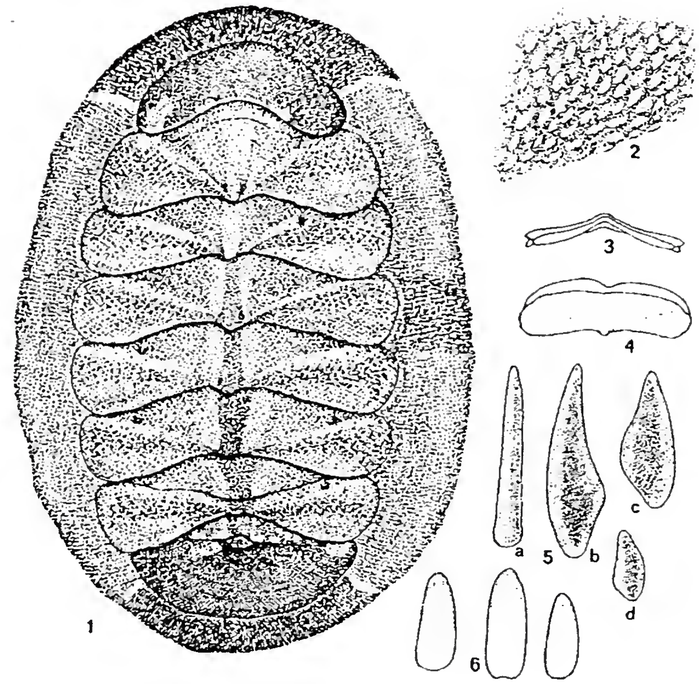

Fig. 33. *Eudoxochiton (E.) nobilis* (Gray), juvenis.

1, whole specimen, dorsal view, ×9.6; 2, granulation of pleural part of central area of valve IV, ×40; 3, valve IV, anterior view, ×4.8; 4, do, dorsal view, ×4.8; 5, dorsal girdle spicules, ×200, a from the narrow (exposed) side, b-c from the broad side, d supra-marginal spicule; 6, ventral girdle scales, ×400.

1-6, specimen from New Zealand, Bay of Islands, Tapeka Point, R.K. Dell leg., NMNZ M5382.

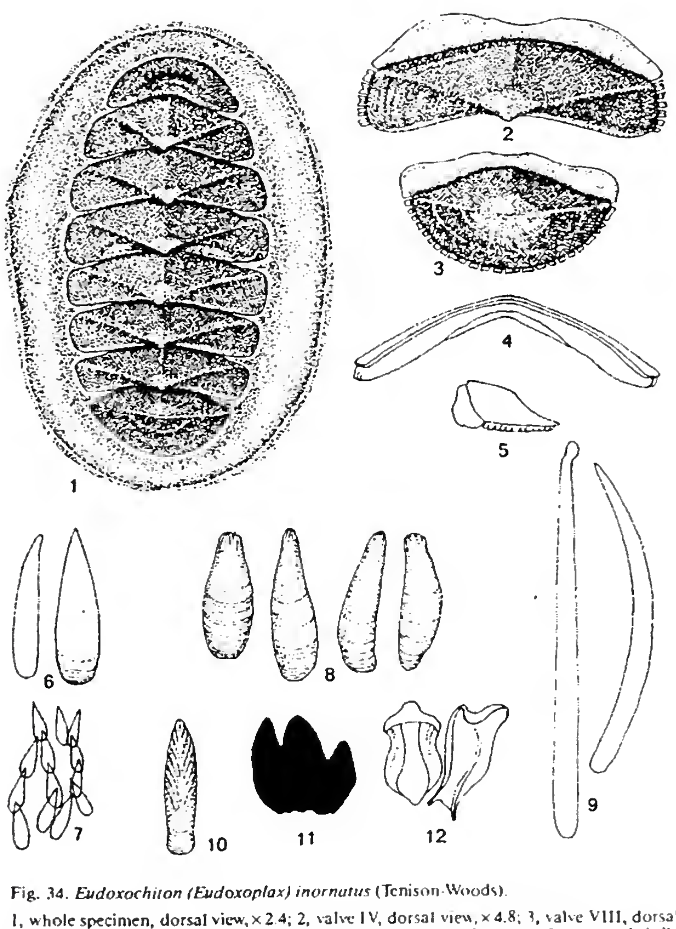

Fig. 34. *Eudoxochiton (Eudoxoplax) inornatus* (Tenison-Woods).

1, whole specimen, dorsal view, ×2.4; 2, valve IV, dorsal view, ×4.8; 3, valve VIII, dorsal view, ×4.8; 4, valve IV, anterior view, ×4.8; 5, valve VIII, lateral view, ×4.8; 6, ventral girdle scales, lateral and ventral view, ×400; 7, do, arrangement, ×100; 8, dorsal spicules, ×400; 9, supra-marginal ringshaft-needles, ×400; 10, marginal spicule, ×400; 11, head of major lateral radula tooth, ×100; 12, central and first lateral radula teeth, ×100.

1-12, specimens from the W coast of N. Bruny Id, Tasmania, -1 m, J.R. Penprase leg., VB 2769.

Conus coronatus Gmelin, 1791 *v.* *C.aristophanes* Sowerby, 1857

W. O. CERNOHORSKY

The taxonomic treatment of these two species has rarely been consistent. Some workers regard *C.aristophanes* to be synonymous with *C.coronatus* or consider the former to be a subspecies of the latter. A subspecific taxonomic treatment is not acceptable since both species are sympatric in distribution with no published records of hybridization to date.

Although sympatric, the two species have a preferred habitat: *C.coronatus* inhabits reef flats where it is usually found under coral rocks on a thin sand covering on a hard reef substrate, usually towards the reef edge. *C.aristophanes* lives in thinly weeded sand, but very occasionally strays under a coral rock.

The two quickest diagnostic characters by which the two species can be differentiated is by the spiral sculpture on the early spire whorls and the shell's colouring. *C.coronatus* has a spiral sculpture of 4-7 fine, but distinct spiral threads, whereas *C.aristophanes* has a much weaker sculpture of 1-3 spiral grooves, The ornamentation in *C.coronatus* consists of 2 brown to blackish-brown transverse bands which are often broken up into irregular blotches, and spiral lines of dots and streaks. In *C.aristophanes* the shell is ornamented with 2 broad , grey, greenish-grey or greenish-brown transverse zones and spiral spots, with the addition of irregular whitish, wavy or zigzag vertical lines. This latter ornamentation is missing in *C.coronatus*. The latter species is also usually more ventricose with its greatest width below the shoulder, while *C.aristophanes* is more conical, with more parallel sides, and usually its greatest width is at the shoulder. Both species have a thin, smooth, translucent yellow to orange periostracum.

In the Fiji Islands and the Society Islands, the author found *C.aristophanes* to be considerably more common than *C.coronatus*.

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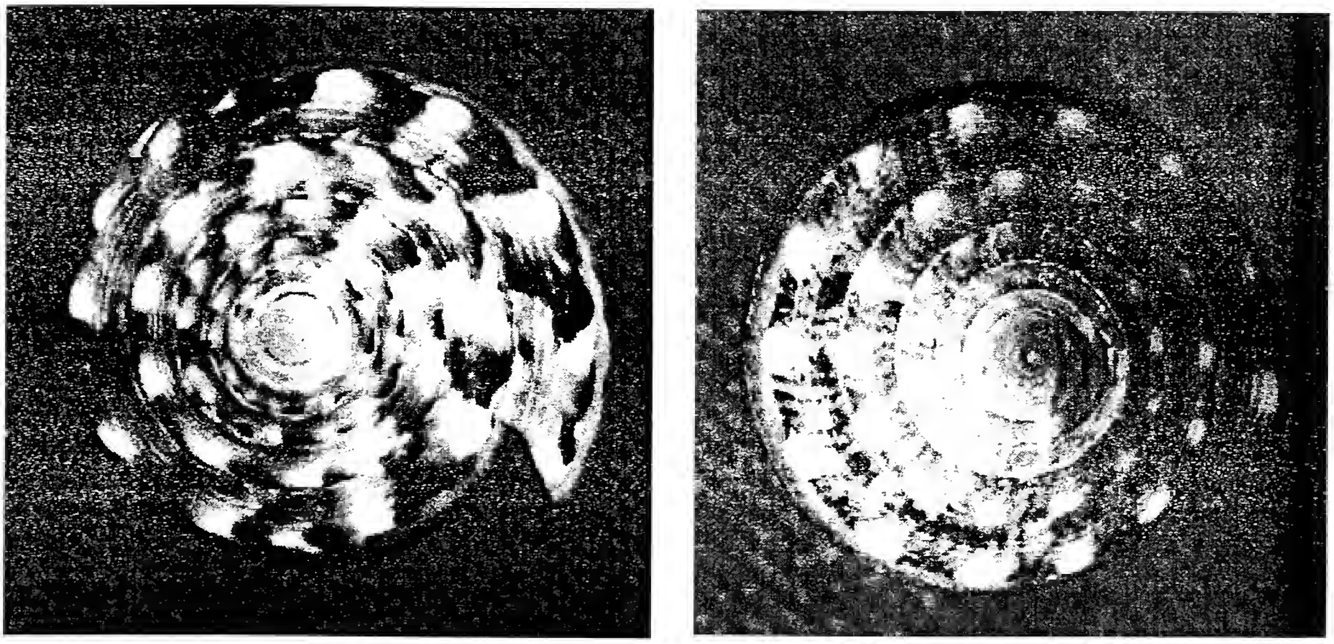
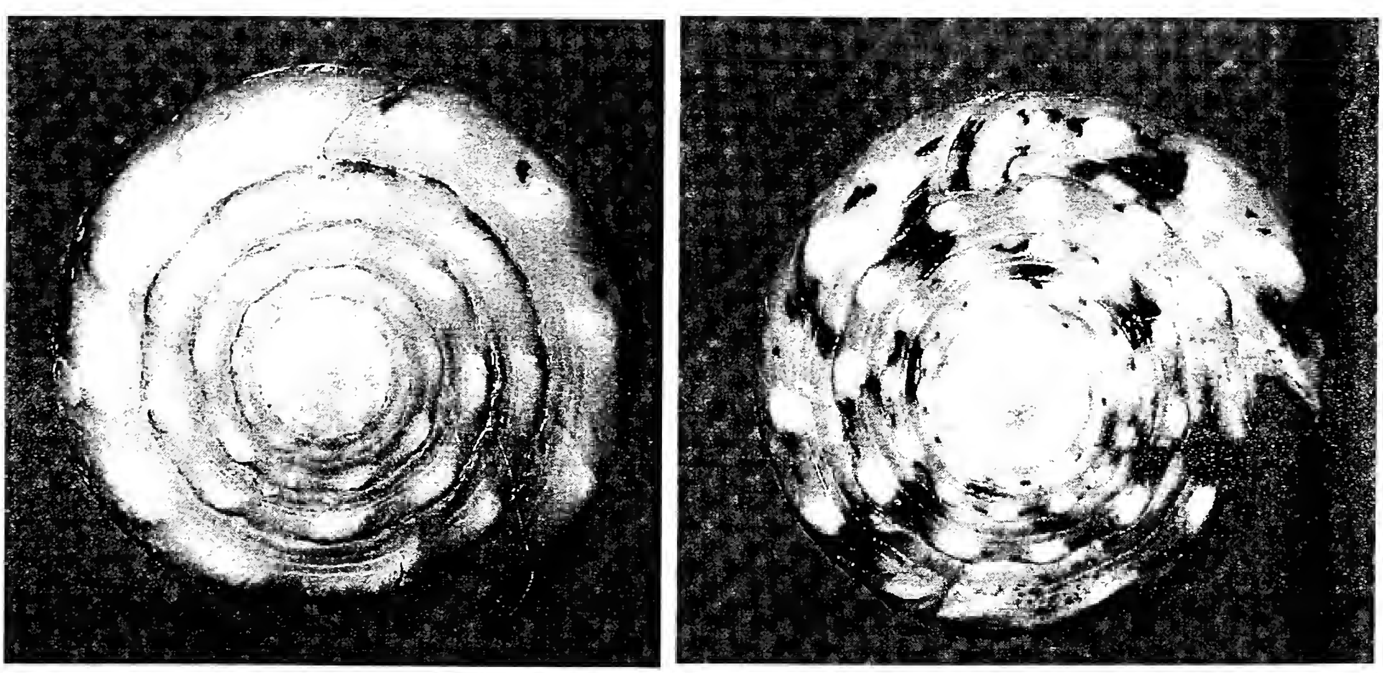


CONUS CORONATUS - Spire view



CONUS ARISTOPHANES - Spire view

CONUS CORONATUS GMELIN, 1791

Fig. 1a

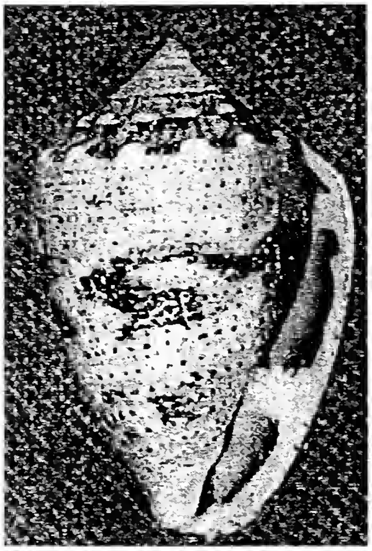


Fig. 1b

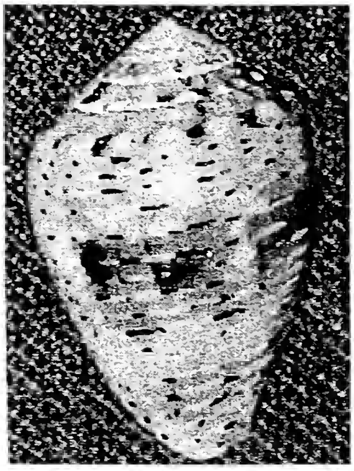


Fig. 1c

Fig. 1d

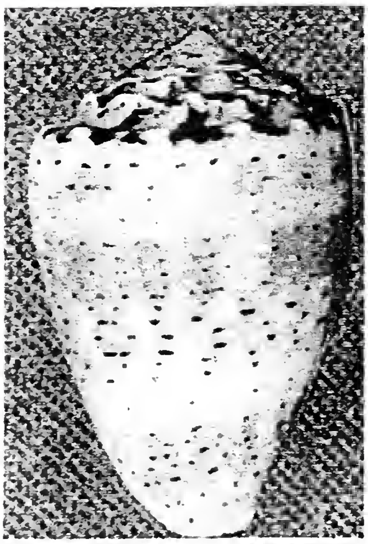


Fig. 2a

Fig. 2b

Fig. 3a

Fig. 3b

Figs. 1a - 1d. Tanna Id., Vanuatu. 1a, 1b. 25.0 x 17.2mm (with periostracum); 1c, 1d. 21.0 x 14.4mm.
Figs. 2a, 2b. Ndai Id., Solomon Ids. 33.0 x 22.3mm
Figs. 3a, 3b, Aitutaki, Cook Ids. 3a. 27.7 x 19.0mm; 3b. 27.8 x 18.7mm

CONUS ARISTOPHANES SOWERBY, 1857

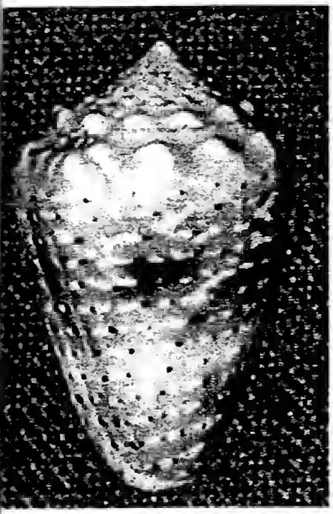


Fig. 1a

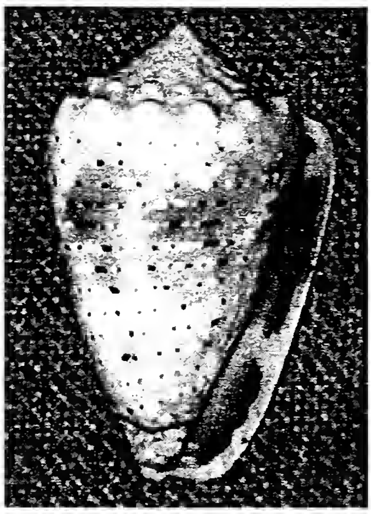


Fig. 1b

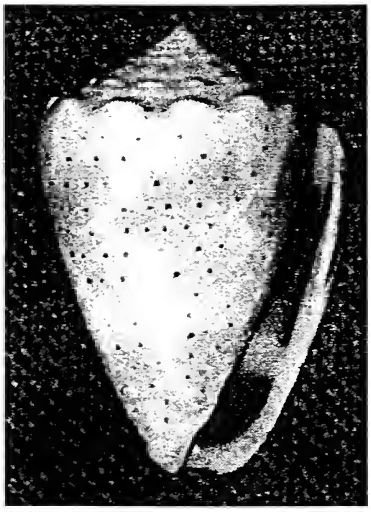


Fig. 2


Fig. 3


Fig. 4a


Fig. 4b

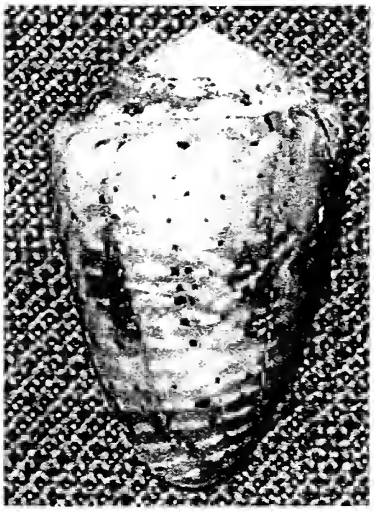


Fig. 5a


Fig. 5b

Figs. 1a, 1b. Aneityum, Vanuatu. 23.8 x 15.3mm
Fig. 2. Piti Channel, Guam Id., Marianas Ids. 23.0 x 16.1mm
Fig. 3. Yadua Id., W. off Viti Levu, Fiji Ids. 22.2 x 14.2mm
Figs. 4a, 4b. Papara, Tahiti, Society Ids. 21.2 x 13.4mm (with periostracum).
Figs. 5a, 5b, Hitiaa, Tahiti, Society Ids. 5a. 21.0 x 13.6mm;
5b. 21.3 x 13.8mm (with periostracum)

Privileged viewing of the nesting mussel, *Modiolarca impacta* (Hermann, 1782)

Margaret S. Morley

At Eastern Beach, Auckland on 12 October 2003, I collected a bunch of washed up squid eggs needed for a photograph. At home I looked at them under the microscope to check if any were still alive. There was no sign of activity in the eggs but a tiny bivalve less than 2 mm long was rapidly vaulting along the surface of the squid eggs (Fig. 1).

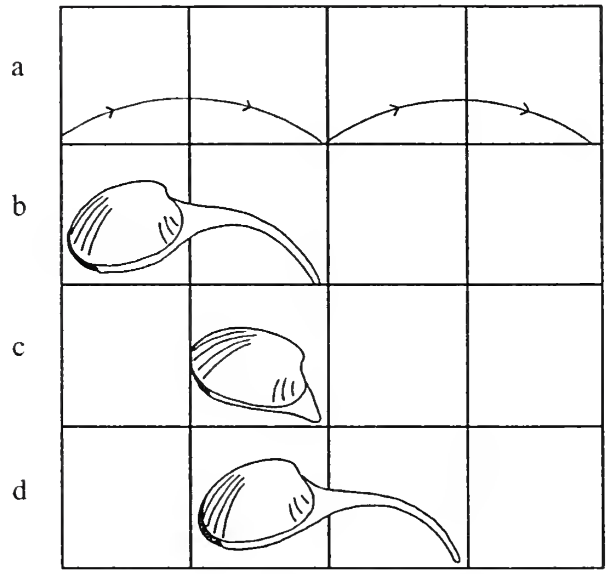


Fig. 1 Movement of juvenile Modiolarca impacta
a. Progress occurs in a series of jerky loops. b. Foot extended, tip secured to substrate. c. Foot contracts strongly pulling the shell forward in a jumping action. d. Tip of foot releases and extends forward again to repeat sequence.

The sculpture on the semi-transparent shell was just developed enough to identify it as a nesting mussel, *Modiolarca impacta*. The hinge was uppermost and the valves partly open. The long, flexible foot extended in front of the valves and the tip adhered to the surface (Fig. 1b). The foot muscle then contracted pulling the shell up to the attached tip of the foot (Fig. 1c). This sequence was repeated (Fig. 1d), resulting in a rapid rate of travel considering the size of the bivalve. The tip of the foot appeared to be investigating the nature of the surface ahead and did not always adhere straight away. There was no sign of byssal threads which create the "nest" around an adult cluster.

An hour later it had stopped moving and had tucked itself inside a tiny pocket of the squid egg membrane. The opportunity to observe this single specimen posed several questions. Did I see a juvenile just settled out of the plankton seeking a suitable place for the next stage in its life cycle? Are byssal threads only secreted to create a permanent abode after a crevice has been found? Since various sizes of *Modiolarca impacta* live enclosed in the same communal nest of byssal threads, mobile juveniles must have a way of finding existing clusters. It seems to suggest that juveniles can

detect and respond to chemicals given off by the adults. If unsuccessful in finding a cluster, can a single specimen survive alone?

Adult *Modiolarca impacta* are covered by a thick, olive-green periostracum and the interior is strongly iridescent. The inflated, oval valves have two distinctive bands of radial ribs at each end of the valves. Apart from some fine, irregular growth lines, the central area is smooth. The sculpture on an adult (Fig. 2) is more developed than on the juvenile observed.

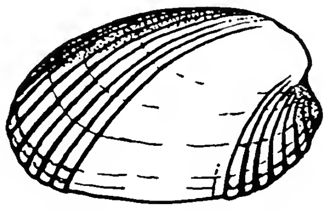


Fig. 2 Adult *Modiolarca impacta*.

Respecting its vigorous efforts to find a home, I suspended the strand of squid eggs with the embedded *Modiolarca impacta* in my aquarium, but have not been able to locate it since.

Acknowledgements
Thanks to Clare Hayward for formatting the article.

OBSERVATIONS ON ALCITHOE ARABICA AT BUCKLANDS BEACH

by Chris Horne

I live at Bucklands Beach, Auckland and regularly walk along it, often seeing live specimens of Alcithoe arabica. I have seen them in shallow water at low tide with foot fully extended, 'gliding' over the seabed and sometimes in the act of grappling with a buried pipi. More often they are found just above the low tide mark exposed on the beach or in various stages of burial. If one lifts these beach specimens up one may find a pipi fully enclosed in the foot or sometimes wrapped around an object in the process of egg laying. Of the 70 egg cases I have found, mostly at the high tide mark after storms, most (40) are laid on dead Maoricolpus roseus shells, a few each on 20mm stones, several on pipi and cockle shells and the rest on various other shells. The M. roseus occur in the deeper water from low tide to the shipping channel in huge numbers.

Sometimes there is one egg case per object but I have a few with two cases and one pebble with three egg cases, two on the stone and one piggy-back on another egg case. Site selection may therefore be a matter of a chance hit on a solid object.

Many of the live specimens have an eroded shell with a slightly green algal tinge and resemble the dead shells around the low tide mark, whether this gives these shallow water dwellers some kind of camouflage value is debateable but it renders them unsuitable for shell collections.

Bucklands Beach has many micro-habitats along its length. At one end, the beach abuts Granger's Reef rock platform. Here the low tide area consists of 20mm pebbles and Alcithoe happily burrow into this. One one occasion I found a volute with its foot totally around a Turbo smaragdus shell, with the operculum dislodged but I could not establish whether this was a feeding or egg-laying episode or perhaps both.

Alcithoe are found all along the beach from pebbly bottom to coarse sand to the muddy sand north of the boat launching ramp.

On one particularly hot summer day when the very low tide coincided with the early afternoon heat I observed around a dozen Alcithoe fully buried in a sand flat, but detectable because they had raised the front of the shell making a small mound in the sand and a tiny opening presumably to allow in air.

The far northern end of the beach ends in an uplifted mud-stone reef with sub-fossil shells of Alcithoe arabica and several kinds of shell which are now rare or absent at Bucklands Beach including Pecten novaezelandiae, Tucetona laticostata, Zenatia acinaces and very large pre-European-sized Cyclomactra ovata. This area would have been more exposed coast before Rangitoto arose.

LANDSNAILS FROM BURGESS ISLAND, MOKOHINAU ISLANDS

Bruce F. Hazelwood

Introduction - D.O.C. Presentation
Science & Research Series No. 70
Mokohinau Islands

The Mokohinau Islands are part of a broken chain of rhyolitic volcanoes within the Coromandel volcanic zone (Browne and Greig 1980) Situated some 110 km NE of Auckland, the group has the potential to provide significant refuges for endangered species. The group consists of Fanal (73 ha), Burgess (56 ha), Maori Bay (11ha),Trig (16 ha) and17 islets ir stacks (Fig. 1). All but a few small out lying stacks were known to have kiore. Both the stag beetle and skink are known only from Stack H, from which kiore have never been recorded. Burgess and Trig have been extensively modified by stock associated with lighthouse keepers, and all islands have been extensively modified by fire. Muttonbirders from Great Barrier Island have frequently burnt the Knights Group. A lighthouse was errected at the summit of Burgess in 1883, and since then stock and fire have reduced the natural vegetation to remnants along cliffs. Most of Burgess is now covered in rank pasture grass, buffalo grass (*Stenotaphrum secundatum),* and club rush *(Scirpus nodosus).* Maori Bay and Trig possess a varied vegetation and provide some idea of what the species composition on Burgess may have been, although only Stack H appears truely unmodified. Both Maori Bay and Trig are dominated by extensive areas of dense flax (*Phormium tenax*), broken by emergent or clusters of pohutukawa (*Metrosideros excelsa)* and ngaio (*Myoporum laetum).* Bare ground beneath the pohutukawa has enabled some hardwoods to establish. The small associated stacks may have escaped fire, but although their vegetation appears little modified, their fauna has been affected by the presence of kiore.

Auckland Conservancy Land Inventory - as at June 1995 Page 174
Mokohinau Islands Nature Reserve

Habitat: Shrubland / Forest
Physical Description: Small rugged group of volcanic islands northwestern of Great Barrier Island. Covered in low coastal forest and shrubland, Steep cliff coastline, 0-150m above sea level. Reserve does not include Burgess Island, which is scenic reserve.
Geomorphology / Geology: Small rugged group of islands with coastal cliffs which are the most remote of the outer Hauraki Islands.
Landscape: Remote group of exposed rocky outcrops distinguished by a cover of stunted vegetation and perimeter of sheer cliffs. High landscape values.
Fauna: Land fauna scarce, 8 lizard species occur, endangered stag beetle, petrels terns and gannet colonies. North Island saddleback release on Fanal Island. Fanal Island most forest birds including red-crowned parakeet, bellbird, N.Z. pigeon, kaka, tomtit and common bush birds.
Flora: Original forest modified by natural fires. Vegetation is mainly coastal species (pohuthkawa, *Coprosma* species and houpara, *Pseudopanax lessonii).* Largest island (Fanal) is half flax, half kohekohe and houpara.
Historic: Hokoromea and Atihau-terraces, midden and findspots. Maori sites associated with muttonbirding.
Fanal: 7 terraces, working floor, midden tapu area. A locally used obsidian source.
Maori Cultural: An important muttonbirding area to the Aotea tribe of Great Barrier Island.
Introduced Animals: Kiore on Fanal Island
Introduced Weeds: Prickly pear cactus
Landing Permit Required

Auckland Conservancy Land Inventory - as at June 1995 Page 28

Burgess Island Scenic Reserve

Habitat: Pasture/Shrubland

Physical Description: One of the rugged Mokohinau Islands of volcanic origin northwest of Great Barrier Island. A lighthouse station, covered mainly in pasture with some coastal shrubland. Has a steep coastline. Over 100m above sea level at highest point.

Geomorphology/Geology: One of the Mokohinau Islands, which are a small rugged group of islands with coastal cliffs and are the most remote of the outer Hauraki Islands.

Landscape: Not assessed

Fauna: Red- crowned parakeet, morepork, pipit. Tui, bellbird and kaka visit the island. Red billed gull colony, nesting sea birds.

Flora: Little remains of original forest cover, due to modification by fire. Coastal forest of pohutukawa, karamu and other species occur, as well as extensive flax.

Historic: Little evidence of prehistoric Maori occupation: six recorded Maori sites (4 rock shelters and 2 other occupation sites) Tapu burial area at boulder beach. Considerable archaeological evidence associated with the lighthouse complex (1882-1979) and World War 2 RNZAF radar station.

Maori Culture: Maori name for the island group is Pokohinu.

Introduced Animals: Farm animals associated with lighthouse removed. Kiore erradicated 1990-1991

Introduced Weeds: Cactus, sweet pea, raspberry, gorse, *Agave americana, Crassula multicava, Crocosmia crocosmiiflora and Watsonia bulbillifera*

Landsnails from Burgess Island

Conchology Section, Auckland Museum Institute

We left Auckland approx. 6am 18/4/2004 for Leigh Harbour, then departed at 8 am by chartered launch, for the Mokohinau Islands. I had heard little of this island group, notably that entomologist Willy Kushell had discovered a new species of native landsnail (Punctid) from somewhere around here, gathered from insect traps. Kushell was present on Burgess Island 27/2/1978. The object of this trip was to relocate this species. There are also reports of some new species of native landsnails from Stack H.

I had a permit to collect litter samples from Burgess Island **only,** which I dried, and sorted out later. On arrival at the islands, we circumnavigated Burgess Island and the Knights Group, but not Fanal Island. The vegetation was very windswept and stunted - consisting mainly of Pohutukawa, Ngaio and flax. The Knights Group to the south - west, commonly called The Flax Islands, were the best vegetated, covered with flax. Pohutukawa occasionly asserted itself.

Burgess Island was immediately recognisable by its lighthouse, perched on the highest point. This island is mainly covered by grass, derived from fire and occupation by stock. The native vegetation has survived on rocky cliffs, and is now slowly regenerating.

At the landing spot at Burgess Island, the sea was high, which made landing impossible. We then cruised round to a beautiful calm bay at Hokoromea Island where the snorkel and scuba brigade splashed into the water. Those left on board had lunch. Tony Enderby was not diving, instead he had a successful time fishing. Heather Smith was nursing an injured arm so was just enjoying the view. The skipper offered to put me ashore, but the permit was only for Burgess Island, so reluctantly I had to refuse.

On returning toBurgess Island the skipper said that it was calmer, so he found a ledge where he could land us from the inflatable. This team was Neville Hudson, Huia Paxton, Luen Jones, Chris Horne and me (Bruce Hazelwood). We were only given 45 minutes to do our collecting so we climbed the steep bouldery cliff, then headed into low-lying pohutukawa scrub. Alison Stanes tramped to the lighthouse, Bruce Hayward, Hugh Grenville and Shungo Kawagata enjoyed the views. Neville, Huia, Luen, Chris and I each took a plastic bag and then took a sample from the

nearby vegetation. There was some drama when it was time to get off the island. The sea was now swelling, so we had to count between swells, then scramble onto the inflatable. Most of us got wet!

Results

1) We found Willy Kushells' new Punctid at all sites. It could be extremely common in the Pohutukawa / Ngaio Belt. Limited numbers were found at 3 sites. Two of these could be due to selection and collecting methods.
2) The sample collected from regenerating Flax was very poor, at this point in time. Future collecting will track any recolonisation by our native snails at this sector of Burgess Island.
3) The Therasia nsp is establishing its position.
4) The Delos nsp seems distinct (very circular) however more specimens are required. These could possibly be found in the gully covered in flax, which leads down to the shore.

I wish to thank my helpers for their support.

Collecting Sites

1) Pohutukawa / Ngaio / small *Coprosma (aff macrocarpa)* / large rocks
(Pohutukawa - Ngaio Belt) B.F.Hazelwood 18/4/2004 S07/009858
2) small Pohutukawa / Hangehange / *Coprosma (aff. macrocarpa)*
(above Pohutukawa - Ngaio Belt) Huia Paxton 18/4/2004 S07/009858 - S07/010859
3) Pohutukawa / Ngaio / rocks / flax, *Phormium tenax*
(Pohutukawa / Ngaio Belt) Neville Hudson 18/4/2004 S07/009858 - S07/010859
4) Pohutukawa / Ngaio / Flax, *Phormium tenax* / *Coprosma (aff macrocarpa)* / *Pimelea sp (aff urvilleana)* - icluded in *P. prostrata* and Flax at side of gully (upper Pohutukawa / Ngaio Belt)
Chris Horne 18/4/2004 S07/010858
5) Flax, *Phormium tenax* / *Coprosma (aff macrocarpa)* grass etc.
(Regenerating grassland) Luen Jones 18/4/2004 S07/010858 - S07/010859

Vegetation on Burgess Island (that we saw/)

Pohutukawa	*Metrosideros excelsa*
Ngaio	*Myoporum laetum*
Coprosma sp	*Coprosma (aff macrocarpa)*
Hangehange	*Geniostoma rupestre*
Pimelea sp	*Pimelea (aff urvilleana)*
Flax	*Phormium tenax*
grass	

Note

Specimens of *Coprosma(aff macrocarpa)* that we observed, were generally very small.
The isopods of Burgess Island look similar but different to those from Leigh. Very different to Waitakere and North Shore specimens.

Species List

Rissellopsis varia (marine)
Phrixgnathus nsp (*aff conella*) (very common) endemic Sp 2000: *Punctid nsp*
Therasia nsp (4 specimens) endemic
Delos nsp (1 specimen) endemic
Tornatellinops novoseelandica (a few)
Oxychilus alliarius (4 specimens) (introduced)

Literature

1994 Ian McFadden and Terry Greene
Science & Research Series No 70
Using Brodifacoum to Erradicate Kiore (*Rattus exulans*)
from Burgess Island and the Knights Group of the Mokohinau Islands
Head Office, D.O.C., PO Box 10-420, Wellington, New Zealand
1995 Anon.
Conservation Management Strategy, for Auckland 1995 - 2005

Vol. 3. Auckland Conservancy, Conservation Managment Planning Series No 1, Dept.of Conservation, Auckland.
Burgess Island Scenic Reserve Page 28
Mokohinau Islands Nature Reserve Page 174

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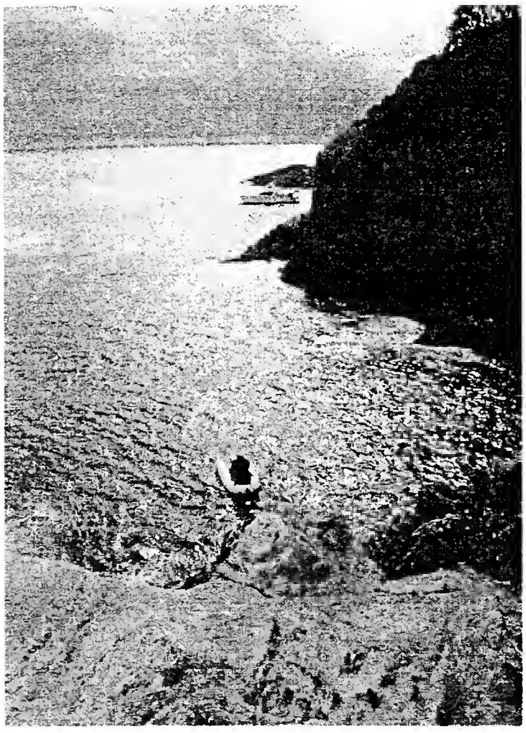
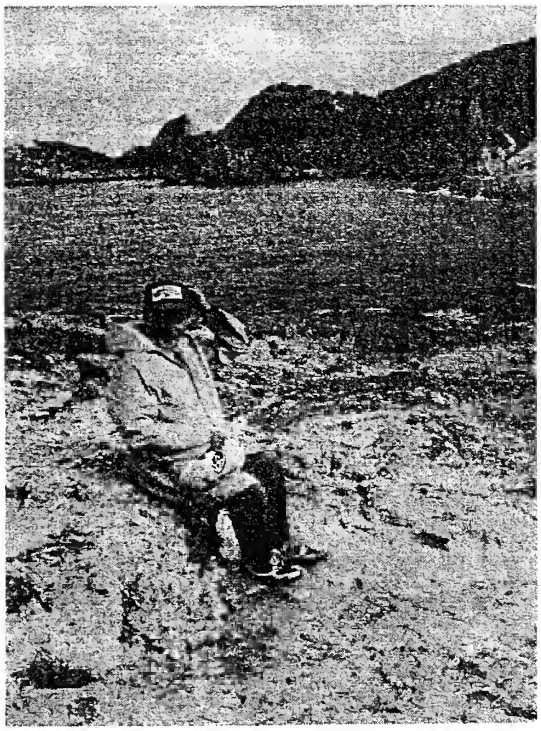
Alison Stanes	for photographs of Burgess Island
Luen Jones	for photographs of Hokoromea Island





Left: Inflatable boat at landing site on Burgess Island with Divercity charter boat in background.
Right: Bruce Hazelwood on Burgess Island.

Presumed *Tonna cerevisina* spawn
Margaret S. Morley

After a northerly gale on 26 June 2004, Andrew Crowe was fossicking on Waikawau Bay on the north-east coast of Coromandel Peninsula (Fig. 1). His efforts were rewarded with several empty tun shells, *Tonna cerevisina* and one with the animal still inside. Among the washed up seaweed he noticed a tough, transparent, plastic-like strap 330 mm long, 80 mm wide and 3 mm thick. Under magnification it was clear that both ends of the strap were sealed so it appeared that the strap was complete. When allowed to lie flat without tension it was shaped like a collar (Fig. 2). The curving rows were composed of 30 to 40 capsules each with a diameter of 2 mm, the capsules contained numerous pink eggs (Fig. 3). The strap, with its enclosed capsules, resembled bubble wrap. Eager to find out what this was, he posted it to me.

The intact, though rather sodden envelope, arrived safely. On close examination under the microscope I could see that each sealed capsule contained fluid and about 100 oval or round pink "eggs" closely arranged in a horseshoe-shaped coil. To my amazement most of the "eggs" were still alive! I cut one capsule open in order to get a better view but still could not see details. There were no structures such as a shell or eyes visible. The surface of the veligers was pimpled and sparkled, with an aperture visible at one end. Short mouth parts like tentacles emerged from the aperture and appeared to be exploring, or possibly eating, adjacent eggs (Fig. 4). Some were extruding clear scintillating bubbles or maybe grains through the mouth. The veligers were rotating causing a current and they had a tendency to clump together. There appeared to be two or more narrow, transparent extensions, known as velum, which created the movement.

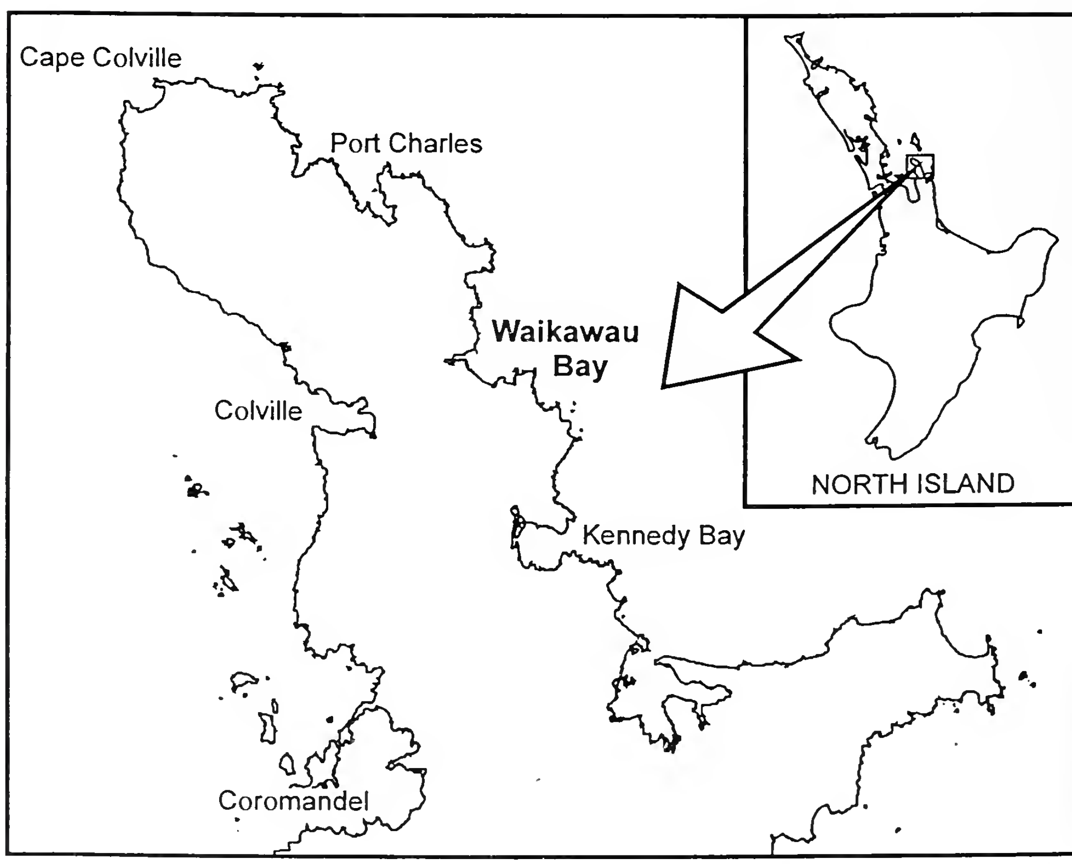


Fig. 1. Map of the north-east coast of Coromandel Peninsula showing Waikawau Bay.

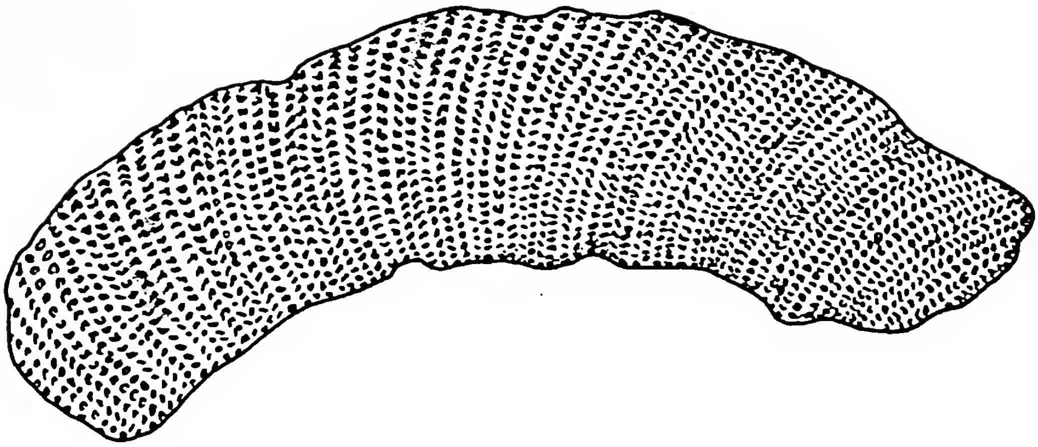
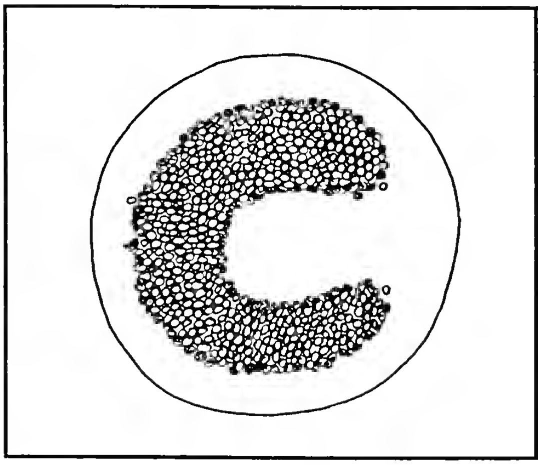


Fig. 2 Spawn strap of *Tonna cerevisina.* Length 330 mm, width 80 mm.

The veligers lived for 2 weeks in seawater getting slightly larger. Towards the end of this time about 80% of the veligers died forming an amorphous mass. Although it was difficult to see details, even under the microscope, I had the impression that those remaining alive were feeding on the mass. If my observation is correct, this method of development has been documented for other species, e.g. *Haustrum scobina,* previously *Lepsiella scobina* (Beu 2004, 213-216). Morton (1967, p.149) says most non-pelagic prosobranchs are fed on nurse eggs which are enclosed in the same capsule but do not develop. Unfortunately at this point in their development the veligers died.



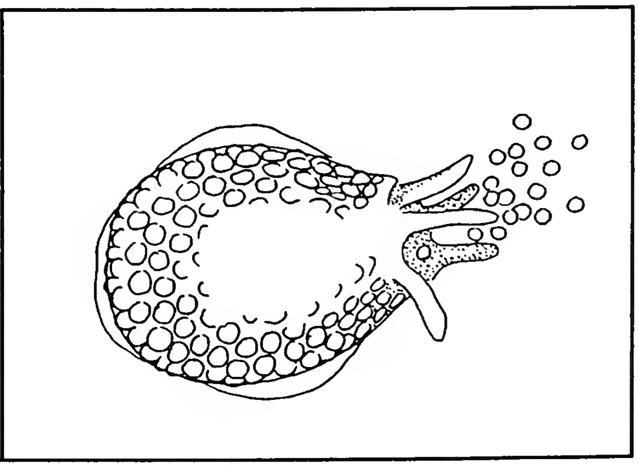


Fig 3: Microscopic detail of a capsule. Diameter 2mm.

Fig 4: One veliger removed from capsule.

The spawn strap is in the marine collections of the Auckland War Memorial Museum (AK 115248).

Discussion

Its shape suggests that it was laid in a semicircle attached to the substrate by the shorter edge with the strap vertical in the water. The diameter would be about the same as the circumference of the aperture of an adult *Tonna cerevisina* (Fig. 5). *Polinices melanostomus* in the family Naticidae have been seen laying spawn in a circular coil around the edge of the aperture of their shell in Aitutaki, Cook Islands (pers. obs.). Few gastropod molluscs are large enough to have produced such a big spawn sheet. The following species can be excluded: The egg capsules of molluscs in the family Ranellidae, such as *Cabestana spengleri,* are well known. These are large capsules laid in leathery baskets which are brooded by the parent (Graham 1941, pers. obs.). Another large gastropod, *Penion sulcatus* lays large capsules attached together in a raised open-work cluster (Boswell, 1970). While snorkelling in the Marlborough Sounds I watched an adult laying the egg cluster. It is occasionally washed ashore. Although the spawn coils of the large nudibranch *Archidoris wellingtonensis* have a similar arrangement of eggs in curved rows, the coils are softer and layed in a spiral of ten turns (Graham, 1941, pers. obs.). Neither octopus nor squid lay a spawn strap (Steve O'Shea pers. comm.).

Information about previous publications on *Tonna cerevisina* spawn or further suggestions for identification will be welcome. In the mean time it is presumed to be the spawn of *Tonna cerevisina,* since several adult specimens including a live one, were washed up in the same place at the same time.

Acknowledgements

Thank you to Andrew Crowe for his sharp-eyed collecting and giving me the opportunity to examine the spawn; Todd Landers (Marine Department, Auckland War Memorial Museum) for taking photographs which assisted drawing; Bruce Hayward for suggesting improvements and formatting the article; Clare Hayward for scanning and preparing the figures and map; and members of the Conchology Section for helping to determine the identity of the spawn.

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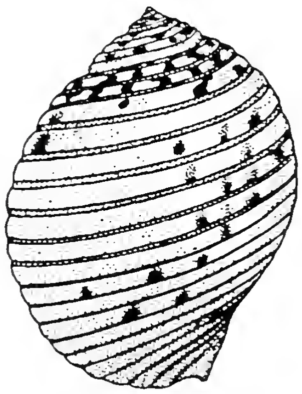

Fig 5: Adult *Tonna cerevisina.* Height 157-230 mm. Drawing by Powell (1987).

Distribution of Marine Molluscs along the Temperate and Cold Water Regions of the Southern Ocean and Adjoining Zones.

by Zvi Orlin (zviorlin@actcom.co.il), Israel

Abstract
A list is presented of the recent taxa shared by the neighbouring regions of the Southern Ocean. Differences are pointed out between the zones studied, and regions discussed.

Introduction
Noting during my collection of marine shells worldwide, that many taxa in the Southern Hemisphere are found in regions widely separated, a special study was launched of the remote regions in and around the Southern Ocean, concentrating on the following five regions:

1. New Zealand – N. and S. Islands, including nearby offshore Islands, Kermadec 28° S. Chatham, and the Antipodean Subantarctic Islands 50° S.
2. Australia – the temperate South Coast and overlap zones on the West coast from Shark Bay 25° S. to the East coast at the N. border of N.S.W. 28° S. including Norfolk Island.
3. South Africa – the Temperate South coast from Margate 31°S. to the West Coasts at Swakopmund 28° S.
4. Magellanic Region – Southern Argentine, from Peninsula Valdez 42° S. to Ancud on Chiloe Island 42° S. in Southern Chile, including the Falkland Islands.
5. Antarctica Region – the Antarctic Continent and islands of the Southern Ocean south of 50° S. but including Kerguelen, Crozet and Prince Edward Islands.

The borders of the regions were determined mainly by the sources of information – see References.

A high degree of Endemism is found in the above regions: New Zealand heads the list with 76%, South Africa 52%, in the Magellanic Region of 627species recorded by D.O.Forcelli, 35% are endemics; for Australia no detailed information has been released so far, but after personal communications with the authors: of F.E.Wells' 671 species described of West Australian shells about 40% are endemic to Australia, and of P.Jansen's 414 species described of South-East Australian shells about 80% are endemic to Australia, these are only partial and preliminary figures; regarding the Antarctic Region, according to the best of my knowledge, no final figures are available.

Owing to the high degree of Endemism, shared species of these five regions are not too common, so the generic level was also noted. These genera are usually found largely in the regions noted, with some spreading into adjoining regions, and most of their species are endemic, in the regions in which they are found.

Results
Summing up the results, 176 families shared species and genera in the different regions:

	Australia	New Zealand	Magellanic	Antarctic	South Africa
Australia		108sp., 157genera	8sp., 71genera	2sp., 52genera	21sp., 38genera
New Zealand	108sp., 157genera		23sp., 95genera	10sp., 73genera	19sp., 40genera
Magellanic	8sp., 71genera	23sp., 95genera		100sp., 32genera	7sp., 22genera
Antarctic	2sp., 52genera	10sp., 73genera	100sp., 32genera		5sp., 14genera
South Africa	21sp., 38genera	19sp., 40genera	7sp., 22genera	5sp., 14genera	

Discussion

According to these results, geographic proximity is of primary importance in determining this distribution. Species similarity usually decreases with geographical distance and is influenced by dispersal limitation. Climatic conditions are an additional important factor, especially in regions where successive Ice Ages are predominant, like the Magellanic and Antarctic Regions and New Zealand. Such changes no doubt effected the evolution and survival of many taxa. Prevailing ocean currents may also be a contributory factor, with the continuous West Wind Drift encircling the globe in the Southern Hemisphere, reaching the regions in this survey, especially for free swimming larval stages of development of some taxa. Hopefully more research will follow in recording the extent of these migrations. Man is the fourth factor affecting distribution, and is becoming increasingly important, both with his effect on the environment, and the wide range of his vessels crossing the oceans, in increasing numbers; also his deliberate introduction of species for commercial reasons, and the occasional transfer for study purposes, which by mistake or inadvertently are released to the environment.

Australia and New Zealand , only separated by the Tasman Sea, have the greatest affinity according to the shared number of taxa shown in the subsequent list, and are influenced by all four of the above factors. The reason for this largest number of shared taxa, is that both reach into lower latitudes, and subsequently into more favourable climatic conditions. Likewise the Magellan and Antarctic Regions, separated by the Drake Passage, are even closer together, and are also affected by all four factors. Worthy of note is the unusual fact, that the shared species of the latter 2 regions are more than double than the shared genera (100 species to 32 genera). In all other zones the number of genera far exceeds the number of species, owing to the eventual evolution of endemic species in many genera. This is due to the relative closer proximity, and more similar climatic conditions. South Africa is the odd one out: surrounded by vast expanses of oceans of thousands of kilometers between it and the other continental regions, its molluscan fauna is more linked to the African countries north, with relatively fewer shared taxa than the other regions in this study.

Perhaps the most interesting fact, is the high number of shared taxa between the Magellanic Region and New Zealand, despite the tremendous distance between them. This may be partly accounted for by the relative proximity in former geological eras, when they were in close proximity, prior to extensive continental plate drift. We must however take into account, that during those geological eras, both South Africa and Australia were also near the present Magellanic Region; this stresses the importance of climatic factors, as the latter's climates are currently more diverse, as they drifted further north from Antarctica. This subject is better left for the Paleobiogeographers, and their findings will be welcomed.

Remarks

An endeavor has been made to relate to species and genera of largely temperate and cold water regions, but this is to some degree subjective and depends on the sources of information used, of which mine are regrettably incomplete; many of the cosmopolitan species or genera were not included, as they were considered predominantly tropical and subtropical in distribution. It must be remembered however that the temperature of the oceans varies in depth, and therefore some of the species or genera found in subtropical or tropical regions, at the edge of, or below the continental shelf, may well live in temperate or cold water habitats. Some of the taxa are also found in temperate and cold water regions of the Northern Hemisphere, and it is considered that these northern genera include many bipolar taxa in the regions of discussion, especially in the Magellanic and Antarctic Regions.

Most of the taxa in the list were found mainly in 2 regions only, but 16sp.and 70 genera were found in 3 regions, and even less are found in 4 or 5 regions. Altogether 450 taxa appear in the list, yet relatively few are found in more than 2 regions; this seems typical of temperate and cold water habitats, that limit distribution, owing to more adverse climatic conditions. In contrast, in tropical and subtropical habitats, distribution is far wider, often extending from island to island, or along continental coasts, over 1 or 2 oceans. For example, over 200species found along South Africa's subtropical east coast, are also found in the Red Sea, at the northern end of the Indian Ocean, and many hundreds of other species are also found scattered over the tropical Indo-Pacific Ocean.

Owing to the differences of opinions between Taxonomists, in some cases alternative names are used for the same genera, occasionally subgenera names are elevated to genera level; in these cases the alternatives have been inserted in parenthesis. Some subfamilies have also been elevated to family level, but the reasons are still being debated, and often the changes are reverted.

This as a preliminary survey, which will hopefully be followed by more detailed studies, and the publication of additional information. The main purpose of this article, is to draw attention to some of the remotest regions of our planet, with their biodiversity in molluscs, and the affinity of these regions in shared taxa.

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Family	Antarctic Region	Magellanic Region	South Africa	Australia	New Zealand
Nacellidae	Nacella concinna, Nacella mytilina	Nacella concinna, Nacella mytilina			
Lepetidae	Iothia coppingeri	Iothia coppingeri			
Lottiidae	Notoacmea, Actinoleuca			Notoacmea	Notoacmea, Actinoleuca
Cocculinidae				Coccopygia crinita	Coccopygia crinita
Pseudococculinidae				Pseudococculina gregaria,Notocrater, Kuritabyssia antipodensis	Pseudococculina gregaria, Notocrater, Kuritabyssia antipodensis
Scissurellidae	Scissurella timora, Sinezona	Scissurella timora	Sinezona, Sukashitrochus	Sinezona, Scissurona (=Incisura) rosea	Sinezona, Incisura rosea,Sukashitrochus
Fissurellidae	Parmaphoridea (=Tugali),Puncturella conica	Tugali, Puncturella conica,Pupilaea	Tugali,Pupilaea Amblychilepas, Cosmetalepas ,Macroschisma	Tugali,Amblychilepas, Cosmetalepas, Montfortula, Macroschisma	Tugali, Montfortula, Puncturella
Trochidae	Antimargarita,Margarella Photinula caerulescens, Photinula expansa, Cantharidus	Margarella,Photinula caerulescens,Cantharidus, Calliotropis, Solariella Diloma nigerrima, Otukaia, Photinula expansa	Diloma, Cantharidus, Granata	Cantharidus, Calliotropis, Clanculus, Granata, Herpetopoma	Antimargarita, Brookula, Otukaia,s.gen. Clanculus Calliotropis, Diloma nigerrima, Herpetopoma, Cantharidus, Solariella, Margarella
Turbinidae			Bolma	Argalista, Munditia, Bolma	Argalista, Munditia, Bolma
Skeneidae (Cyclostrematidae)	Brookula,Cyclostrema crassiolatum,Cirsonella Lissotesta, Liotella	Brookula, Cyclostrema crassiolatum, Cirsonella	Brookula	Brookula,Lissotesta Liotella,Lodderena	Cirsonella, Lissotesta. Lodderena
Seguenziidae	Seguenzia antarctica		Seguenzia antarctica	Seguenzia	Seguenzia
Neritidae				Nerita atramentosa	Nerita atramentosa
Turritellidae	Colpospirella algida	Colpospirella algida		Maoricolpus roseus, (introduced from N.Z)	Maoricolpus roseus
Siliquariidae				Tenagodus weldii Stephopoma	Tenagodus weldii Stephopoma
Batillariidae				Zeacumantus subcarinatus (introduced from N Z)	Zeacumantus subcarinatus
Littorinidae	Laevilitorina calignosa, Macquariella	Laevilitorina calignosa,		Laevilitorina, Austrolittorina	Laevilitorina, Austrolittorina, Macquariella
Eatoniellidae	Eatoniella cana	Eatoniella cana, Pupatonia		Eatoniella, Crassitoniella	Eatoniella, Pupatonia, Crassitoniella
Cingulopsidae	Skenella georgiana	Skenella georgiana		Skenella, Tubbreva	Skenella, Tubbreva
Rastodentidae				Rastodens	Rastodens
Barleeidae		Fictonoba			Fictonoba
Anabathridae	Pisinna,Anabathron		Pisinna, Microdryas	Microdryas,Anabathron Amphithalamus	Microdryas,Anabathron Amphithalamus
Rissoidae	Powellisetia australis Onoba georgiana	Powellisetia australis, Onoba georgiana, Pusillina		Powellisetia, Lironoba	Powellisetia australis Onoba, Pusillina, Lironoba

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Family	Antarctic Region	Magellanic Region	South Africa	Australia	New Zealand
Elachisinidae				Dolicrossea	Dolicrossea
Vitrinellidae				Elachorbis	Elachorbis
Triviidae				Trivia merces	Trivia merces
Velutinidae	Marseniopsis pacifica	Marseniopsis pacifica		Mysticoncha	Mysticoncha
Naticidae	Amauropsis, Falsilunatia Sinuber sculptum sculptum Friginatica, Tectonatica impervia	Amauropsis, Falsilunatia Sinuber sculptum sculptum, Tectonatica impervia	Tanea	Tanea, Friginatica	Tanea, Friginatica Falsilunatia
Bursidae				Bursa verrucosa	Bursa verrucosa
Cassidae			Semicassis pyrum,Semicassis labiata	Semicassis pyrum Semicassis labiata Semicassis royana Semicassis thomsoni	Semicassis pyrum Semicassis labiata Semicassis royana Semicassis thomsoni
Ficidae			Thallasocyon bonus	Thalassocyon bonus	Thalassocyon bonus
Laubierinidae				Akibumia orientalis	Akibumia orientalis
Ranellidae		Argobuccinum pustulosum, Fusitriton magellanicus	Argobuccinum pustulosum,Ranella australasia, Charonia lampas	Argobuccinum pustulosum,Ranella australasia, Fusitriton magellanicus, Charonia lampas rubicunda	Argobuccinum pustulosum, Ranella australasia, Fusitriton magellanicus, Charonia lampas rubicunda
Tonnidae			Tonna variegata	Tonna variegata cerevisina (s.s ?), Tonna tetracotula	Tonna cerevisina Tonna tetracotula
Atlantidae				Atlanta turriculata	Atlanta turriculata
Carinariidae				Carinaria lamarcki	Carinaria lamarcki
Pterotracheidae				Pterotrachea scutata	Pterotrachea scutata
Triphoridae				Metaxia, Teretriphora Nototriphora,Monophorus Sagenotriphora ampulla	Metaxia,Teretriphora Nototriphora Monophorus, Sagenotriphora ampulla
Cerithiopsidae	Ataxocerithium,Eumetula Cerithiopsilla,Cerithiella	Ataxocerithium, Eumetula Cerithiopsilla		Ataxocerithium, Zaclys, Specula, Socienna, Prolixodens infracolor	Ataxocerithium,Zaclys Specula, Socienna Cerithiella,Eumetula, Prolixodens infracolor
Janthinidae			Recluzia rollandiana	Recluzia	Recluzia rollandiana
Epitoniidae	Acirsa, Asperiscala eltanini	Acirsa, Asperiscala eltanini, Papuliscala		Murdochella,Opalia Epitonium jukesianum	Acirsa, Papuliscala Murdochella,Opalia Epitonium jukesianum
Eulimidae	Balcis antartica, Balcis subantarticus	Balcis antarctica, Balcis subantarticus, Pelseneeria		Pelseneeria, Fusceulima	Pelseneeria, Fusceulima
Muricidae	Trophon geversianus, Trophon ohlini, Trophon laciniatus, Xymenopsis muriciformis	Trophon geversianus, Trophon ohlini,Trophon laciniatus, Xymenopsis muriciformis	Murexsul,Neothais (=Dicathais) orbita	Dicathais orbita, Prototyphis, Syphochelus Phyllocoma speciosa, Lepsiella, Haustrum, Babelomurex lischkeanus	Murexsul, Prototyphis,Dicathais orbita Syphochelus,Lepsiella Phyllocoma speciosa Babelomurex lischkeanus,Haustrum

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Turbinellidae			Coluzea	Coluzea	Coluzea
Buccinidae	Antarctodomus, Falsitromina,Pareuthria Meteuthria, Chrysodomus	Falsitromina,Aeneator Pareuthria, Meteuthria, Chrysodomus	Cominella,Ratifusus	Cominella, Penion, Ratifusus adjunctus, Ratifusus reticulatus	Antarctodomus, Aeneator,Pareuthria Cominella, Penion Cumia(=Ratifusus) adjuncta, Cumia reticulata
Nassariidae			Nassarius kraussianus	Nassarius ephamillus, Nassarius spiratus, Nassarius kraussianus	Nassarius ephamillus, Nassarius spiratus
Volutidae	Miomelon turnerae, Miomelon altanini, Provocator pulcher Guivillea, Tractolira	Miomelon turnerae, Miomelon altanini, Provocator pulcher, Guivillea, Tractolira	Lyria	Lyria nucleus	Lyria nucleus, Provocator
Olividae	Baryspira longispira	Baryspira longispira		Amalda (Baryspira), Gracilispira	Amalda (Baryspira), Amalda(Gracilispira)
Harpidae				Morum bruuni	Morum bruuni
Marginellidae				Dentimargo, Mesoginella Ovaginella	Dentimargo, Mesoginella,Ovaginella
Cystiscidae			Cystiscus	Cystiscus	Cystiscus
Mitridae				Mitra carbonaria	Mitra carbonaria
Volutomitridae	Volutomitra fragillima Volutamitra porcellana	Volutomitra fragillima, Volutomitra porcellana	Microvoluta	Volutomitra (Waimatea) obscura, Microvoluta Peculator porphyria	Volutomitra obscura, Microvoluta Peculator porphyria
Costellariidae			Austromitra	Austromitra	Austromitra
Cancellariidae	Admete	Admete, Zeadmete	Zeadmete	Zeadmete, Inglisella Bonellitia	Zeadmete,Admete, Inglisella, Bonellitia
Turridae	Aforia lepta, Aforia staminea,Leucosyrinx Belalora theilei, Mangelia michaelseni	Aforia staminea, Drillia Belalora theilei,Mangelia michaelseni,Leucosyrinx Agladrillia	Agladrillia, Drillia Splendrillia,Taranis Maoritomella, Maorimorpha Mitramorpha Antiguraleus	Splendrillia,Maoritomella Austrodrillia	Aforia lepta,Leucosyrinx Taranis, Splendrillia Maoritomella, Maorimorpha, Antiguraleus,Mitramorpha Austrodrillia
Terebridae				Terebra tristis	(Terebra)Pervicacia tristis
Conidae				Conus howelli	Conus howelli
Orbitestellidae	Microdiscula	Microdiscula, Orbitestella		Orbitestella	Orbitestella
Xylodisculidae				Xylodiscula	Xylodiscula
Mathildidae	Mathilda	Mathilda		Opimilda decorata, Mathilda	Opimilda decorata, Mathilda
Architectonicidae				Adelphotectonica reevei Philippia lutea, Pseudotorinia	Adelphotectonica reevei Philippia lutea, Pseudotorinia
Omalogyridae	Omalogyra antarctica	Omalogyra antarctica		Omalogyra	Omalogyra
Pyramidellidae	Chemnitzia,Turbonilla smithi	Chemnitzia, Eulimella Turbonilla smithi		Eulimella, Linopyrga, Chemnitzia, Turbonilla	Chemnitzia, Eulimella, Linopyrga

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Acteonidae	Neactaeonina				Neactaeonina
Hydatinidae			Hydatina albocincta		Hydatina albocincta
Diaphanidae	Diaphana paessleri, Toledonia parelata Toledonia punctata Toledonia limnaeformis	Diaphana paessleri, Toledonia parelata Toledonia punctata Toledonia limnaeformis		Diaphana brazieri Diaphana tasmanica	Toledonia, Diaphana brazieri, Diaphana tasmanica
Cylichnidae				Cylichna thetidis, Tornatina	Cylichna thetidis Tornatina
Retusidae	Cylichnina	Cylichnina	Volvulella		Cylichnina, Volvulella
Philinidae	Philine alata, Philine kerguelensis	Philine alata, Philine kerguelensis		Philine angasi	Philine angasi
Aglajidae				Melanochlamys, Philinopsis taronga	Melanochlamys, Philinopsis taronga
Gastropteridae	Gastropteron		Gastropteron	Gastropteron	
Haminoeidae				Limulatys	Limulatys
Bullidae				Bulla angasi, Bulla quoyii	Bulla angasi, Bulla quoyii
Plakobranchidae				Elysia maoria	Elysia maoria
Limapontiidae		Ercolania, Limapontia		Ercolania, Limapontia	Ercolania, Limapontia
Aplysiidae				Aplysia juliana, Aplysia parvula	Aplysia juliana, Aplysia parvula
Pleurobranchidae	Bathyberthella	Berthella	Pleurobranchaea	Berthella mediatas, Pleurobranchaea maculata	Bathyberthella, Berthella mediatas, Pleurobranchaea maculata
Limacinidae	Limacina helicina	Limacina helicina, Limacina retroversa	Limacina helicina	Limacina helicina	Limacina helicina, Limacina retroversa
Cavolinidae		Clio antarctica			Clio Antarctica
Pneumodermatidae	Schizobrachium polycotylum	Spongiobrachaea australis	Spongiobrachaea australis	Spongiobrachaea australis	Spongiobrachaea australis Schizobrachium polycotylum
Clionidae	Clione limacina antarctica	Clione limacina antarctica	Clione limacina	Clione limacina antarctica, Thliptodon	Thliptodon
Goniodorididae		Okenia		Okenia pellucida, Trapania brunnea	Okenia pellucida, Trapania brunnea
Onchidorididae		Acanthodoris	Acanthodoris	Acanthodoris	Acanthodoris
Polyceridae		Polycera, Thecasera	Polycera capensis. Polycera hedgpethi	Polycera capensis, Polycera hedgpethi	Polycera hedgpethi, Thecasera
Dorididae	Austrodoris kerguelensis	Austrodoris kerguelensis Archidoris		Archidoris wellingtonensis	Archidoris wellingtonensis
Chromodorididae	Cadlina	Cadlina	Cadlina	Cadlina	Cadlina
Tritoniidae	Tritonia challengeriana Tritonia vorax	Tritonia challengeriana Tritonia vorax, Marionia		Marionia	Tritonia
Dotidae		Doto		Doto	Doto
Phylliroidae		Phylliroe bucephala			Phylliroe bucephala
Arminidae		Armina	Armina	Armina,Dermatobranchus pulcherrimus	Armina,Dermatobranchus pulcherrimus

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Discodorididae		Geitodoris, Rostanga	Geitodoris, Rostanga muscula	Rostanga muscula	Geitodoris, Rostanga muscula
Zephrynidae			Janolus	Janolus hyalinus, Caldukia	Janolus hyalinus, Caldukia
Flabellinidae	Flabellina falklandica	Flabellina falklandica	Flabellina	Flabellina, Tularia	Flabellina,Tularia
Eubranchidae		Eubranchus agrius	Eubranchus		Eubranchus agrius
Aeolidiidae		Spurilla		Aeolidiella	Spurilla, Aeolidiella
Tergepedidae	Cuthona georgiana	Cuthona georgiana	Cuthona	Cuthona	Cuthona
Facelinidae		Phidiana	Phyllodesmium serratum	Phidiana, Phyllodesmium serratum	Phidiana
Fionidae				Fiona pinnata	Fiona pinnata
Onchidiidae		Onchidella		Onchidella patelloides	Onchidella patelloides
Siphonariidae	Kerguelenella lateralis	Kerguelenella lateralis			Kerguelenella
Ellobiidae		Marinula		Marinula, Ophicardelus	Marinula, Ophicardelus
Nuculidae	Pronucula, Ennucula	Ennucula	Pronucula	Pronucula	Pronucula
Nuculanidae	Yoldiella valletei,	Yoldiella valletei,		Jupiteria, Poroleda, Propoleda(? Siliculidae)	Yoldiella, Jupiteria, Poroleda
Neilonellidae				Pseudotindaria	Pseudotindaria
Tindariidae		Tindaria			Tindaria
Solemyidae		Acharax			Acharax
Siliculidae	Propeleda longicaudata, Silicula	Propeleda longicaudata, Silicula			
Mytilidae	Aulacomya ater, Dacrydium	Aulacomya ater, Choromytilus, Dacrydium	Aulacomya ater, Choromytilus	Modiolus areolatus, Adipicola, Dacrydium, Trichomusculus barbatus, Xenostrobus pulex	Aulacomya, Adipicola, Trichomusculus barbatus, Modiolus areolatus, Xenostrobus pulex, Dacrydium
Arcidae	Bathyarca	Bathyarca		Bathyarca	Bathyarca
Limopsidae	Limopsis hirtella , Limopsis knudseni, Limopsis marionensis	Limopsis hirtella,, Limopsis knudseni, Limopsis marionensis		Limopsis, Pectunculina	Pectunculina
Philobryidae	Philobrya capillata, Philobrya olstadi, Philobrya sublaevis, Philobrya wandelensis, Lissarca notocadensis, Lissarca miliaris, Verticipronus	Philobrya capillata, Philobrya olstadi, Philobrya sublaevis, Philobrya wandelensis, Lissarca notocadensis, Lissarca miliaris		Lissarca, Philobrya	Lissarca, Philobrya, Verticipronus
Limidae	Limatula hodgsoni, Limatula pygmea, Escalima	Acesta, Limatula hodgsoni, Limatula pygmea		Acesta,Divarilima sydneyensis, Limaria orientalis, Limatula	Acesta, Divarilima sydneyensis, Escalima, Limaria orientalis, Limatula
Ostreidae		Ostrea chilensis			Ostrea chilensis
Pectinidae	Psychrochlamys patagonica,Cyclopecten, Hyalopecten, Propeamussium meridionale	Psychrochlamys patagonica, Cyclopecten	Cyclopecten	Psychrochlamys delicatula, Mesopeplum convexum (introduced), Cyclopecten kapalae	Psychrochlamys delicatula, Mesopeplum convexum, Cyclopecten kapalae, Propeamussium meridionale Hyalopecten,

Family	Antarctic Region	Magellanic Region	South Africa	Australia	New Zealand
Anomiidae				Anomia trigonopsis	Anomia trigonopsis
Lucinidae	Lucinoma lamellata	Lucinoma lamellata Epicodakia		Epicodakia	Lucinoma, Epicodakia
Thyasiridae	Genaxinus bongraini, Genaxinus debilis, Thyasira falklandica	Genaxinus bongraini, Genaxinus debilis, Thyasira falklandica		Genaxinus, Parathyasira	Genaxinus, Parathyasira
Lasaeidae	Lasaea consanguinea	Lasaea consanguinea		Lasaca. Arthritica,Mylitta Borniola, Melliteryx	Lasaea, Arthritica, Mylitta Borniola,Melliteryx
Kellidae	Kellia simulans	Kellia simulans			
Montacutidae	Mysella charcoti, Mysella miniscula, Sciobcretia australis	Mysella charcoti, Mysella miniscula, Sciobcretia australis		Mysella	Mysella
Cyamiidae	Cyamium Cyamiocardium denticulatum,Cyamicardium crassilabrum, Perrierina Cyamiomactra laminifera	Cyamium, Cyamicardium denticulatum, Cyamicardium crassilabrum Cyamiomactra laminifera		Cyamiomactra, Perrierina	Cyamionactra, Perrierina
Neolcptonidae	Neolepton umbonatum	Neolepton umbonatum		Neolepton	Neolepton
Sportellidae				Anisodonta	Anisodonta
Carditidae	Carditella, Cyclocardia astartoides	Carditella, Cyclocardia astartoides	Carditella	Carditella, Cyclocardia	Carditella
Condylocardiidae				Benthocardiella, Hamacuna,Condylocardia, Condylacuna, Volupicuna	Benthocardiella, Hamacuna,Condylocardia Condylacuna,Volupicuna
Crassatellidae				Talabrica	Talabrica
Astartidae	Astarte longirostris	Astarte longirostris			
Cardiidae				Pratulum	Pratulum
Tellinidae				Macomona, Pseudarcopagia	Macomona, Pseudarcopagia
Gaimardiidae	Gaimardia trapesina, Kidderia bicolor, Kidderia pulsilla, Kidderia exilis	Gaimardia trapesina, Kidderia bicolor, Kidderia pulsilla, Kidderia exilis		Gaimardia	Gaimardia trapesina (different s.s.)
Veneridae	Tawera	Tawera, Protothaca	Eumarcia, Sunnetta contempta	Tawera spissa,(introduced from NZ) Bassina, Notocallista, Ruditapes largillierti,(introduced from NZ) Eumarcia, Sunnetta contempta	Tawera spissa,Protothaca Bassina, Notocallista, Ruditapes largillierti
Hiatellidae	Hiatella arctica, Hiatella solida	Hiatella arctica, Hiatella solida, Panopea	Hiatella arctica	Panopea, Hiatella	Hiatella arctica,Panopea
Pholadidae		Xylophaga		Xylophaga	Xylophaga
Teredinidae		Bankia		Bankia australis, Lyrodus pedicellatus, Nototcredo edax	Bankia australis, Lyrodus pedicellatus, Nototcredo edax

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Parilimyidae				Parilimya	Parilimya
Thraciidae	Thracia meridionalis	Thracia meridionalis			Thracia meridionalis
Periplomatidae				Offadesma angasi, Pendaloma micans	Offadesma angasi, Pendaloma micans
Clavagellidae			Clavagella australis	Clavagella australis	
Lyonsiidae	Lyonsia arcaeformis	Lyonsia arcaeformis			
Myachamidae				Myochama tasmanica, Myodora antipodum	Myochama tasmanica, Myodora antipodum
Cleidothaeridae				Cleidothaerus albidus	Cleidothaerus albidus
Verticordiidae				Spinosipella ericia, Haliris	Spinosipella ericia,Haliris
Lyonsiellidae	Lyonsiella	Lyonsiella		Lyonsiella	Lyonsiella
Poromyidae	Poromya adelaidis	Poromya adelaidis		Poromya undosa	Poromya undosa
Cuspidariidae	Cuspidaria infelix, Cuspidaria tenella Subcuspidaria kerguelensis	Cuspidaria infelix, Cuspidaria tenella, Subcuspidaria kerguelensis		Plectodon, Pseudoneaera, Rhinoclama	Plectodon, Pseudoneaera, Rhinoclama
Lepidopleuridae	Leptochiton kerguelensis	Leptochiton kerguelensis		Leptochiton	Leptochiton
Hanleyidae	Hemiarthrum setulosum	Hemiarthrum setulosum			
Ischnochitonidae	Callochiton bouveti, Callochiton gaussi, Nutallochiton hyadesi, Nutallochiton mirandus	Callochiton bouveti, Callochiton gaussi, Nutallochiton hyadesi, Nutallochiton mirandus, Chaetopleura	Chaetopleura, Lepidozona, Callochiton	Callochiton crocinus, Lepidozona, Eudoxochiton	Callochiton crocinus, Lepidozona, Eudoxochiton
Schizochitonidae				Loricella profundior	Loricella profundior
Mopaliidae	Plaxiphora aurata				Plaxiphora aurata
Chitonidae				Chiton glaucus, Sypharochiton pelliserpentis(introduced)	Chiton glaucus, Sypharochiton pelliserpentis
Dentaliidae	Fissidentalium majorinum	Fissidentalium majorinum		Fissidentalium	Fissidentalium
Gadilidae	Cadulus dalli, Siphonodentalium	Cadulus dalli	Cadulus	Cadulus	Cadulus, Siphonodentalium
Sepiadaridae				Sepioloidea pacifica	Sepioloidea pacifica
Sepiolidae				Iridoteuthis	Iridoteuthis
Loliginidae				Sepioteuthis australis	Sepioteuthis australis
Lycoteuthididae				Lycoteuthis lorigera	Lycoteuthis lorigera
Enoploteuthididae				Enoploteuthis galaxias	Enoploteuthis galaxias
Pyroteuthididae		Pterygioteuthis		Pterygioteuthis gemmata, Pyroteuthis margaritifera	Pterygioteuthis gemmata, Pyroteuthis margaritifera
Octopoteuthididae		Taningia danae		Taningia danae	Taningia danae
Onychoteuthididae	Kondakia	Kondakia, Onychoteuthis banksii, Moroteuthis ingens		Moroteuthis, Onychoteuthis	Onychoteuthis banksii, Moroteuthis ingens
Gonatidae		Gonatus antarcticus			Gonatus antarcticus
Architeuthididae		Architeuthis		Architeuthis	Architeuthis

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Histioteuthididae		Histioteuthis atlantica	Histioteuthis atlantica Histioteuthis miranda	Histioteuthis atlantica, Histioteuthis macrohista	Histioteuthis atlantica, Histioteuthis miranda, Histioteuthis macrohista
Ommastrephidae	Martialia hyadesi	Martialia hyadesi, Todarodes filippovae		Todarodes, Notodarus gouldi	Martialia hyadesi, Notodarus gouldi, Todarodes filippovae
Chiroteuthididae		Chiroteuthis	Chiroteuthis	Chiroteuthis	Chiroteuthis
Mastigoteuthidae				Mastigoteuthis	Mastigoteuthis
Cranchiidae		Galiteuthis		Leachia, Cranchia scabra, Teuthowenia pellucida	Leachia, Cranchia scabra Teuthowenia pellucida, Galiteuthis
Vampyroteuthidae			Vampyroteuthis infernalis	Vampyroteuthis infernalis	Vampyroteuthis infernalis
Opisthoteuthididae				Opisthoteuthis	Opisthoteuthis
Amphitretidae				Amphitretus	Amphitretus
Vitreledonellidae				Vitreledonella richardi	Vitreledonella richardi
Octopodidae	Graneledone, Thaumeledone,Pareledone Benthoctopus	Pareledone, Benthoctopus		Octopus warringa (=huttoni), Pinnoctopus maorum (=cordiformis)	Octopus huttoni, Pinnoctopus cordiformis, Pareledone, Benthoctopus Graneledone, Thaumeledone
Tremoctopodidae				Tremoctopus violaceus (=robsonianus)	Tremoctopus robsonianus
Ocythoidae		Ocythoe tuberculata		Ocythoe tuberculata	Ocythoe tuberculata
Argonautidae			Argonauta nodosa	Argonauta nodosa	Argonauta nodosa

Tributes to Joan Coles
1915-2004
Past President and Life Member

This was one of the tributes at Joan's funeral. We thought that we knew the conchologist and naturalist side of Joan's life, and it would be interesting to see her professional life. I don't know Avril's other name, I always knew her as Avril. She had the advantage, having Joan's phone book.

When I first started at St Helens as a student midwife in 1969, she was Miss Coles, the "Matron" and has remained Miss Coles, a friend. She retired in 1970, but remained very much a part of St Helens and was always a special guest at any of our anniversaries, she was the Matriarch.
She loved her flowers and her Christmas lilies were a floral feature in the main foyer at St Helens each year for the Christmas carol evening. Some of those lilies are still in her garden. She always loved picking her flowers as soon as they bloomed, she got such pleasure from having them inside and visible, rather than outside where she had to go out to see them.
In 1995, a group from St Helens were there among others to help celebrate her 80th birthday and from there a close association developed. The day after her 83rd birthday she tripped over the lead of the electric blanket and landed in Middlemore Hospital with a broken hip. From her hospital bed she could give directions where to find anything she wanted, since being so well organised, she knew where everything was kept and it would be there. She was back driving in six weeks, though she'd have been behind the wheel sooner had she been allowed.
Birthday 84 produced a pulmonary embolism and a quick trip to Auckland Hospital by ambulance, but being the resilient lady she was, she was soon out and about again, busy with church duties, and visiting those friends less mobile than she was. That is, as soon as she'd finished the Herald crossword each morning.
Just after her 86th Birthday, she flew to Wellington to the Centennial celebration for the Registration of Nurses, held in Parliament's Great Hall.
That was the last of her trips outside Auckland, but she still traversed Auckland, including to the Henderson tip, since her green garden bin was always overflowing. These trips were so frequent she must have had a concession ticket.
She was always a keen attender of St Helen's reunion dinner after its closure in 1990, this last year was the only time where she felt unable to cope with a late meal and evening. She was starting to slow down.
Having made three Christmas cakes each year, the Shell Club one for many years, last year was to be the last time.
This amazing lady had many interests and retained so many connections over the years. Her memory was wonderful and she could name staff from years back and tell you whom they had married and how many children, too.
Professionally, Miss Coles was greatly respected by all who knew her. Every year she attended Auckland Girls Grammar Old Girls lunch and she kept her interest in the Auckland Hospital Nurses Assn. These and others like the Conchology Club and Forest and Bird, she was involved with to the end.
She will be missed by many.

Dear Joan,

I have vivid memories of a ride in your car to a club trip to the Coromandel Peninsula. This was soon after I joined the Conchology Section in 1979 when I did not know any common shell names, let alone the scientific ones. At the time, Dr Powell's book New Zealand Mollusca had just been published to much rejoicing by members, because all the names and descriptions were at last in one volume. Anyhow, on this trip, I had to balance Powell's book on my lap and quiz you on all the name changes while you were driving! My stumbling pronunciation was cause for much mirth. You took me to many extra beaches on the way back to show me what to look for and to learn the shells' names.

One of your favourite stories concerned another club trip to an island south of Kawau. You explained to new members that the trumpet shell, *Charonia lampas* lived under ledges at low tide. To illustrate the point, you bent down to feel under a ledge where you were standing, to your amazement (and everyone else's) there was the shell! This incident gave you quite a reputation.

Lunches at your place were a delicious treat of home baking, I especially liked the grainy wholemeal loaf. The recipe came from Houhora in the days when there were no roads, so all bread had to be home baked. There was no kneading required.

Trays entered at many Shell Shows were often on interesting themes. I remember one you entered in the educational class showing specimens of the turban shell, *Cookia sulcata* collected on a voyage by Captain Cook.

Tucked away under the house, your shell room held many carefully catalogued specimens, both from New Zealand and overseas. Some trays were self-collected in New Hebrides and New Caledonia during trips with the Conchology Section. Visitors never left empty handed, but always carried away a gift to add to their own collection. Despite reminders, they often took away a bump on their head as well from the low doorway!

Whenever help was needed to track down specific shells needed for science, you were always keen to assist and often gave away the specimen required. Sometimes your large library also produced answers. I treasure a book you gave me on Campbell Island.

You deserved more than the one Life Membership for all the years of work and contributions to the Shell Club, including many years on the committee and as President. There was also much patience required when dealing with the temperamental gestetner to produce newsletters. For over 40 years we enjoyed your annual Christmas cake carefully decorated with reindeer and *Poirieria* shells.

We shall all miss your cheery smile, positive attitude, and expertise in the world of molluscs.

Love,
Margaret

POIRIERIA

Auckland Museum

Conchology Section

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We welcome contributions on suitable topics, typed if possible, using Times New Roman 12pt, with titles 16pt bold, and author 14pt bold. Your co-operation will help keep the appearance of our journal consistent. If a photo is to be included please allow an appropriate space in the text. A printed copy on A4 paper should be sent to: Jenny and Tony Enderby, PO Box 139, Leigh 0947, New Zealand.

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All correspondence regarding membership, change of address, distribution queries, back issues, etc should go to: The Secretary, Private Bag 92018, Auckland, New Zealand.

Conchology Section 75th Celebrations
September 16-18 2005

The efforts of every body involved in the 75th celebrations were truly rewarded with such a successful weekend. THANKYOU to the team of Margaret Morley, Betty Headford, Glenys Stace, Gladys Goulstone and Nancy Smith for their hard work and to all those who made contributions in various ways.

Judging by the noise on Friday evening at the Epsom Community Centre everyone had a great time. Old friends were reunited, shells were sold and swapped, stories unfolded and photos confirmed many exciting expeditions.

Saturday morning a number of people visited and viewed shell collections at Heather Smiths' and Peter Poortmans'. By lunchtime some keen members joined Margaret Morley and Dr. Richard Willan at Torpedo Bay and made the most of a really low tide.

Saturday evening at the museum began with wine and a delicious supper prepared by Rosa Tyson. Rodney Wilson CEO of the Auckland War Memorial Museum gave us an update on the progress of the Museum alterations. Dr. Leslie Newman curator of the Marine Dept. thanked members of our club who work tirelessly as volunteers in the Dept. Dr. Ken Grange opened up a new world for us in his presentation "Technology Advances in Sampling our Coastal Environment". The animated trip under the sea around Cook Strait and Wellington Harbour took us where we are most unlikely ever to go!! This was followed by a stunning Power Point Memorabilia Presentation put together by Betty Headford.

Sunday morning saw some of us up with the birds being guided around the museum collection with Margaret, Glenys and Dr. Richard Willan. Lunch was shared by many members at The Epsom Community Centre. Dr Richard Willan presentated "Nudibranchs as a Sentinel of Global Warming." What an informative, thought provoking, visual presentation this was. We were honoured to have Prof. John Morton and Noel Gardner cut the delicious 75th cake (baked by Rosa Tyson.) Prof. Grant-Mackie auctioned 12 lots of Joan Coles shells. This was followed by a very entertaining and noisy Multi Draw raffle. What a great weekend!

Monday morning saw three vehicles headed north to Houhora and a visit to the Grange's. Maria Van Diemen didn't yield any great finds but Spirits Bay had a huge wash up - and scallops in large quantities were enjoyed for the next few days. The most exciting finds were a Semicassis sophia at Spirits Bay and a rare slug, Melanochlamys lorrainae at Paua. Both discoveries were made by Margaret Morley who froze her slug and cuddled and protected her Semicassis sophia all the way back to Auckland!!

We were honoured to have so many people who travelled vast distances to celebrate our 75 th Anniversary: Dr. Richard Willan from Darwin (who remind me that he is a NZER) Ena Coucom from Yeppoon, Queensland, Jack Austin from Philip Is. Victoria, Dr. Ken Grange from Nelson, Jenny Raven, Pat Lakeman and Kris Wood from Wellington, Bob and Betty Grange from Houhora, Derrick and Anne Crosby from Whakatane, Ann Randall from Mt. Maunganui, Gwenda Henderson and Shirley Osborne from Whangarei. What a tribute to have our Patron Prof. John Morton with us and to see some of the more long standing members: Noel Gardner, Olive Snook, Derek Lamb. Anne Randall, Alan Peterson and Rae Sneddon, And of course, all our Auckland members from every corner of our city: Leigh, Orewa, Oratia, Titirangi, Bucklands Beach, Pakuranga, Albany, Papatoetoe, Takanini, Howick, Kaukapakapa, and many more suburbs. Great to see Dr. Bruce Hayward, Jenny and Tony Enderby, Mike and Val Hart, Lynette Hellyar, Martin Walker and Tim Saunders.

53 people in all attended our celebrations.

75th Celebrations

Sunday get together at the Epsom Community Centre

Club Patron, Prof. John Morton and Noel Gardner with the 75th Celebration cake made by Rosa Tyson

Betty Headford, Glenys Stace, Margaret Morley, Nancy Smith and Gladys Goulstone

Rae Sneddon, Margaret Morley and Olive Snook

Pat Lakeman, Kris Woods, Heather Smith and Jenny Raven

Short Note

A field trip to Torpedo Bay, Devonport on September 17 2005 was included in the 75th celebrations. We all had an enjoyable search among the low tide rocks, especially as Richard Willan was present to share his expertise. The most notable finds were two living murex *Muricopsis octogonus* spotted among rocks and seaweed at low tide by Pat Lakeman and Kris Woods from Wellington. While this species could be found occasionally around the Auckland Harbour in the past it had gradually died out by 1995 (pers. obs.) due to the biocide tributyltin (TBT) in antifouling paint (Scott 1993). This poison changes females into males and males themselves become impotent.

These are the first living specimens seen since their demise. Hopefully now that the use of TBT paint is illegal the murex are starting to make a comeback.

Reference

Scott, I.R. 1993 The effects of tributyltin upon New Zealand neogastropods and the impact the partial ban has had on its usage. Unpublished Msc thesis, University of Auckland.

Margaret Morley

Members and Guests who attended the weekend of 75th celebrations 16-18 September 2006

Austin Jack
Brissolles Michael
Bycroft Barbara
Coucom Ena
Crosby Ann
Crosby Derrick
Enderby Jenny
Enderby Tony
Gardner Noel
Goulstone Gladys
Grange Betty
Grange Bob
Grange Ken
Grant-Mackie Jack
Hart Mike
Hart Val
Hayward Bruce
Hazelwood Bruce
Headford Betty
Hellyar Lynette
Henderson Gwenda
Horne Chris
Hudson Neville
Jones Luen
Lakeman Pat
Lamb Derek
Morley Margaret
Morton John (Patron)
Newman Leslie
Osborne Shirley
Peterson Alan
Poortman Peter
Randall Anne
Randall Kevin
Raven Jenny
Riley Jenny (nee Oates)
Saunderson Tim
Smith Heather
Smith Nancy
Sneddon Rae
Snook Doug
Snook Judith
Snook Olive
Stace Glenys
Thompson Fiona
Tyson Rosa
Walker Martin
Warwick Christine (nee Grange)
Willan Richard
Wilson Rodney
Woods Kris

Seventy-five Jubilations in Northland

Margaret S. Morley and Heather D. Smith

Introduction

When dates were first considered for the celebration of the 75th jubilee of the Conchology Section of the Auckland Museum Institute we were keen to coincide with spring tides. This gave an opportunity to include field trips over the weekend itself and a longer visit to the far north the following week. In the event we only managed to fit in the day visit to Torpedo Bay on the Saturday, having to cancel the trip to Maori Bay on the Sunday because of gale force winds. It was no great hardship to stay at Epsom and eat cake instead! As it turned out these ferocious winds were to be of great benefit later.

To make the most of the 0.2 m tides eight members left Auckland early Monday morning, September 19 2005; Glenys Stace drove her van with Betty Headford, Fiona Thompson and her Australian visitor Jack Austin. Heather Smith and her twin sister Alison Stanes traveled in their motor home with guest Margaret Morley, Lynette Hellyar accompanied the second group in her own motor home. Our itineraries were somewhat independent (Fig. 1), but we all enjoyed the hospitality of Bob and Betty Grange at Houhora on our way to and from the north. The view across the wide sweep of Houhora Harbour from the Granges' conservatory, further enhanced by a rainbow, made you plan to leave Auckland for good!

A species list has been compiled of the various beach walks and snorkel. The emphasis is mainly on molluscs, a total of 265 species (8 chitons, 177 gastropods, 76 bivalves, 1 scaphopod and 3 cephalopods) were observed. With more time available additional species could be added by detailed searches at high tide, plus algal and rock washes for microscopic shells. Other phyla are recorded as they were encountered.

The introduced parchment worm *Chaetopterus* sp. and bivalves *Musculista senhousia* and *Myochama tasmanica* are recorded from Rangiputa, Rangaunu Harbour.

Recent mollusc name changes are listed at the end.

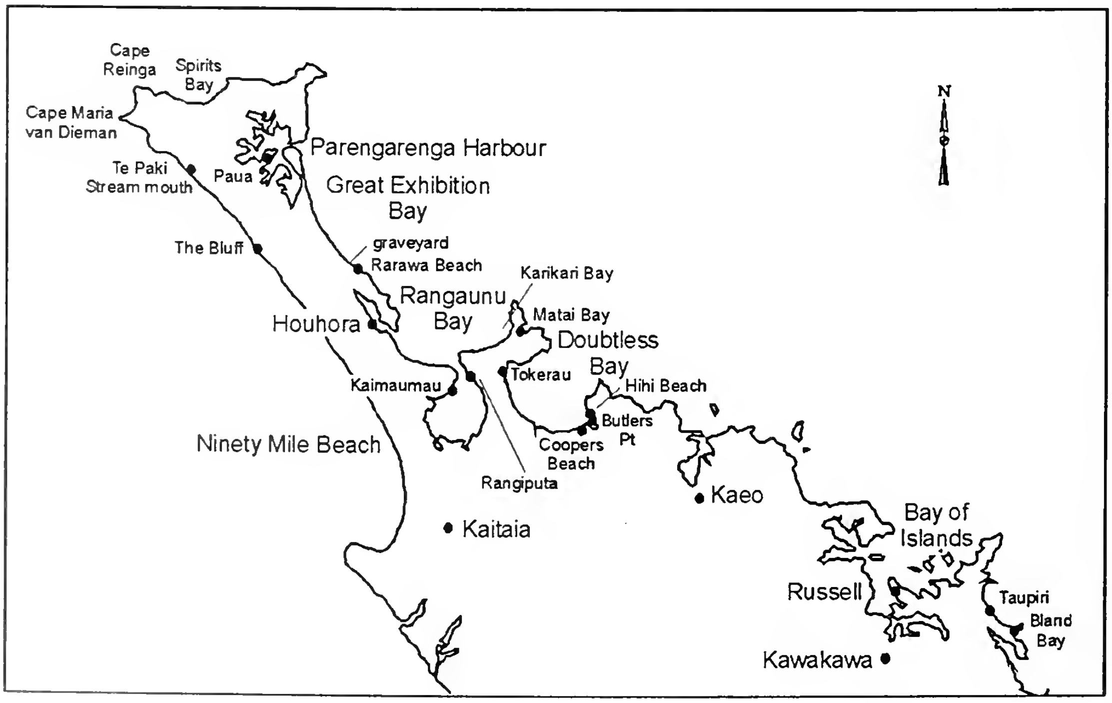

Fig. 1. Map of Northland sites visited, September 19-27 2005.

Houhora Heads

Although there was a substantial wash up at Houhora Heads it appeared to be quite old. Best finds were brightly coloured pink and purple dog cockles *Tucetona laticostata*, beaded top shells *Calliostoma punctulatum* and knobbed whelks *Austrofusus glans.* As is often the case, *Tonna cerevisina* was only represented by pieces. Only the most dedicated collectors persevere in such cold squally winds and sand tornadoes.

Rarawa

The sea had a tropical look with layers of deep blue blending to greens and turquoise. The graveyard around the rocky headland had a wide range of mollusc species though the majority had some damage. After much looking among the drifts of wheel shells *Zethalia zelandica* some good specimens were found of the volute *Alcithoe haurakiensis*, large wentletraps *Boreoscala zelebori*, trumpet shells *Ranella australasia* and *Cymatium parthenopeum.* Bivalve species included fan shells *Talochlamys zelandiae* and pairs of lace cockles *Divalucina cumingi.* Heather and Alison continued on round the rocks to Great Exhibition Bay but reported clean sands.

Paua, Parengarenga Harbour

A snorkel had been planned by the wharf which previously has been very exciting with live bubble shells *Bullina lineolata, Hydatina physis,* whelks *Nassarius spiratus,* beaded top shells *Calliostoma punctulatum* and *C. tigris,* nudibranchs *Chromodoris aureomarginata* and *Ceratosoma amoena.* However conditions on arrival were atrocious, the gale force westerlies creating short choppy waves hell-bent on churning up the silt. A walk across the sand flats was deemed a slightly better option.

Much of the sea grass *Zostera* between the cliffs and Dog Island has disappeared, though this may be due to seasonal changes. Some cockles *Austrovenus stutchburyi*, were still present but were smaller and in lower numbers than remembered from earlier visits, possibly the result of a period of commercial harvesting about fifteen years ago.

Other molluscs living on the sand and *Zostera* flats were sparse only one specimen of *Cymatium parthenopeum,* a few *Ranella australasia* and low numbers of white bubble shells *Haminoea zelandiae* seen. Living, dying and dead feathery sea hares *Bursatella leachii* were common. Beds of pipi *Paphies australis* are present near Dog Island (Bob Grange pers. comm.) Fiona had a special find of a rare gastropod *Sassia parkinsonia* around the margin of Dog Island (Fig. 2). Empty pairs of the razor mussel *Solemya parkinsonii* lay on the surface near low tide.

At low tide 0.2 m it was tempting to retreat out of the howling wind and sand flurries but our patience was rewarded when molluscs emerged from the sand as the tide began to flow back in. There were a few small olives *Amalda australis*, followed by two white muscular slugs *Philine angasi,* then a 20 mm very mucousy opisthobranch slug, like *Melanochlamys cylindrica* but pale instead of black. The details of this rare *M. lorrainae* are being studied for a future publication. This species has a small, frail internal shell.

Tokerau

Finds here included granose turban *Modelia granosa,* opal top shell *Cantharidus opalus* and large trophon *Xymene ambiguus.*

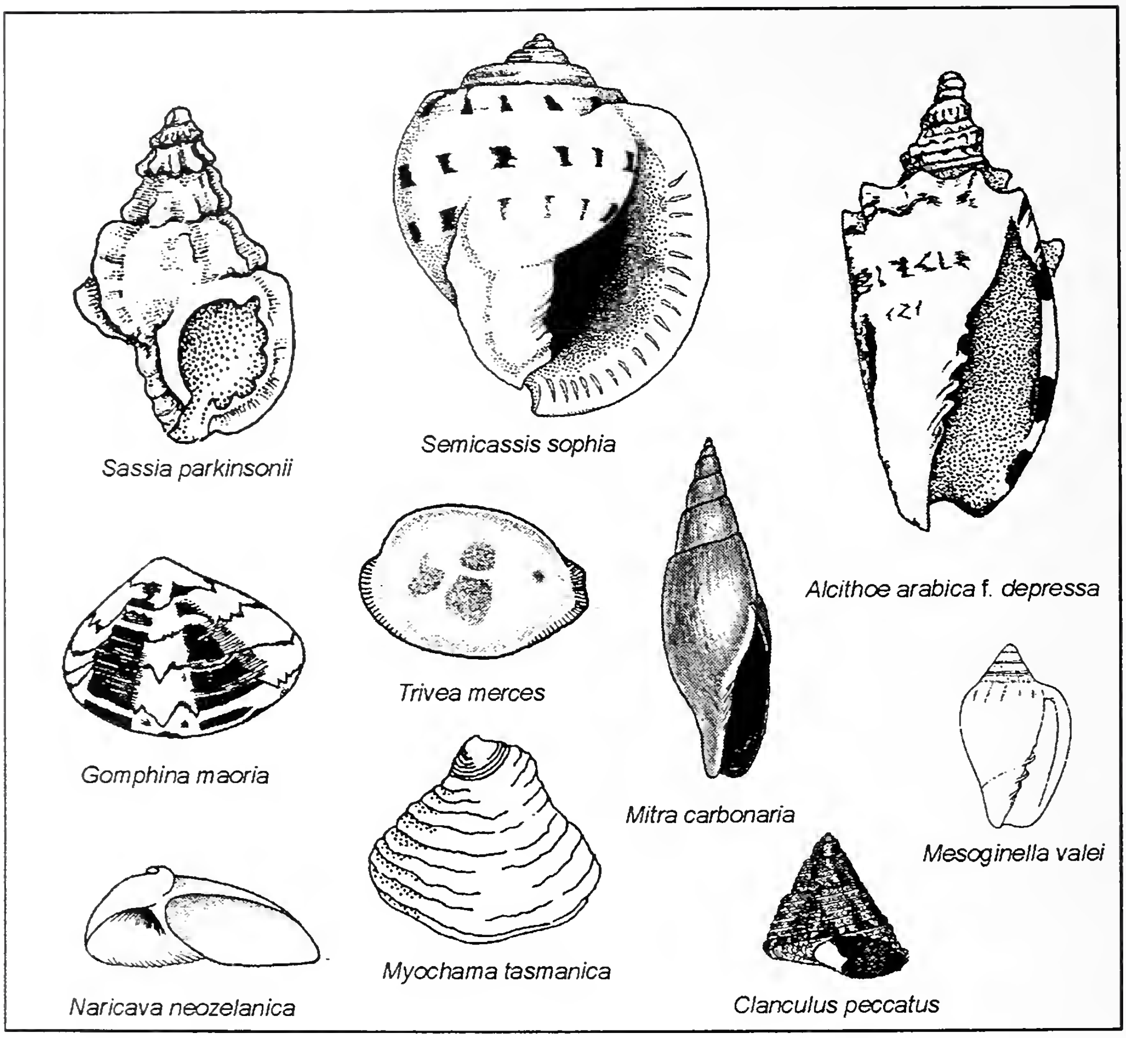

Fig. 2. Some special finds. Drawings by Margaret Morley and Powell (1979).

At the northern end were many washed up shells stained black e.g. speckled whelk *Cominella adspersa,* ringed dosinia *Dosinia anus*. The spire and body whorl of ostrich foot shells *Struthiolaria papulosa* were black but had a contrasting white aperture.

The Mother of all wash ups at Spirits Bay

The northerly gales of the previous week resulted in a spectacular wash up on Spirits Bay. Four of us in the motor homes arrived late in the evening. A speedy rush across the sand dunes to the beach confirmed an exciting array of live scallops *Pecten novaezelandiae,* just in time for tea! Also numerous were live, long trough shells *Oxyperas elongata* on the tide line towards Pananehe Island, their thick siphon tips are reddish pink. At first light the next morning a search turned up some treasures around the island.

Cape Maria van Diemen

Despite our energetic morning at Spirits Bay Alison, Heather and Margaret parked by the Cape Reinga lighthouse to walk the track to Cape Maria. There is a steep descent to Te Werahi Beach, a walk to the western end, then a climb over sand hills and back down to Cape Maria. Plenty of the protected Holocene fossil flax snails *Placostylus*

ambagiosus lay exposed or weathering out of the sand dunes. We did have a short rain squall but clear blue skies dominated the day. Magnificent coastal views more than made up for the lack of shells on the beach, though Heather was pleased to find a keyhole limpet *Monodilepas diemenensis* and a rather worn tusk shell *Fissidentalium zelandicum.* The total walk was about 11 km.

Spirits Bay again

An uncontested change of plan saw the motor homes return to Spirits Bay. The wash up had continued and now extended about one kilometre west towards the centre of Spirits Bay. More scallops were added to the bulging bags, swiftly followed volutes, the depressa form of *Alcithoe arabica.* There were so many we were able to choose the best, but despite having the animal still inside, few had intact protoconchs. The long joined siphons of geoducks *Panopea zelandica* protruded from their valves, these were often damaged where gulls had pecked to get at the animal. Large specimens of purple fan shells *Talochlamys zelandiae* were in perfect condition embedded in sponge. The interior of the dog cockle *Tucetona laticostata* valves were home to purple tinted slipper shells *Sigapatella tenuis* measuring up to 30 mm in diameter.

Many big, bright red hermits peered out from large gastropod shells. Metre wide swathes of grass green seaweed *Caulerpa brownii* lay prostrate on the sand. Amongst all the variety of debris other surprises emerged e.g. a pair of purple wavy fan shells *Mesopeplum convexum*, a live helmet shell *Semicassis labiatum,* one intact *Tonna ceresvisina.* With the evidence of extensive offshore sponge gardens it seemed a likely place to find an *Umbraculum* but success was celebrated prematurely on finding a nudibranch *Doris wellingtonensis.* Several large oar stars *Ophiopsammus maculata,* with a diameter of 30 cm, suffered arm damage during their wild ride ashore.

Margaret was delighted to uncover from a pile of seaweed and sponges a specimen of the rare helmet shell *Semicassis sophia* (Fig. 2). It was in good condition only recently vacated by a hermit crab. This species is also known from Australia. Later we saw in Bob Grange's collection a whole row of them including one washed in alive at Rarawa!

A multitude of vivid sponges came in colours of scarlet, purple, orange and yellow, some the size of washing up bowls or the purple finger species up to 40 cm long. Long specimens of organ pipe sponge decorated both large rocks and upper scallop valves. Big pink *Balanus* barnacles were still alive attached to dead shells. Also common were beautiful delicate tunicates, hydroids, bryozoans and red algae.

It was inevitable that we picked up far too much, the bags rapidly became heavier and heavier. None was left behind though! It seemed a long way back to the motor home across soft sand. The rest of that morning was spent cleaning shells and packing (Fig 3). The motor home rear locker became perilously overloaded!

The Bluff and Te Paki stream mouth

Two brief visits by the two groups found the west coast unproductive and extremely wind blown. The only shells washed in were single bivalves.

Kaimaumau

A pleasant walk on firm white sand towards the heads of Rangaunu Harbour gave plenty to look at on the tide line. Most interesting were large numbers of *Xymene ambiguus*, some with egg cases attached to the male shells, *Cymatium parthenopeum, Ranella australasia* and *Charonia lampas.*

Fig. 3 Heather Smith cleaning shells at Spirits Bay.

Karikari Beach
The twins hoped to ride their bikes along the sand but unfortunately the erosion of the sand dunes by the sea had created a 3m drop off to the beach. Although they could remember this beach as a rich area previously, on this occasion there was little of note.

Mangonui- Butlers Point Whaling Museum
A morning spent here was most enjoyable. We were impressed with the dedication of the owners to their whaling boat, Butlers' house and colonial history so well displayed. The carefully tended garden was dominated by a magnolia tree 160 years old and one of the biggest pohutukawa in New Zealand. We admired views of Mangonui Harbour from the adjacent pa site.

Coopers Beach
It was noted that the oyster borer *Haustrum scobina* is in high numbers and that all the oysters examined were the endemic *Saccostrea glomerata.* Over fifty relatively common molluscs were collected from the tide line (see species list). Heather plans to produce a comprehensive list from Coopers Beach in a future issue.

Rangiputa, Rangaunu Harbour from Gillies Road. Evidence for leathery tubeworm *Chaetopterus;* and bivalves *Musculista senhousia* and *Myochama tasmanica*
A complete, freshly dead specimen of the Asian mussel *Musculista senhousia* suggests a population is nearby.

Evidence of another invader, probably in the Rangaunu channel, was the leathery tubes of the polychaete worm *Chaetopterus* sp. Attached was a single right valve of *Myochama tasmanica* (Fig. 2), an unexpected bonus, not found until after the trip. The type specimen comes from Tasmania. It is known from Parengarenga Harbour in 6 m

(Powell 1979), Bay of Islands (Morley and Hayward 1999), Poor Knights Islands and Medlands, Great Barrier Island (MM coll.). Maximum measurements given by Powell (1979) are width 14 mm height 12 mm, the Rangiputa specimen exceeds these with a width 20 mm and height 16 mm.

At the head of the harbour among the mangroves were pockets of washed up shells. Oysters living on the mangrove trunks and branches were all *Crassostrea gigas.*

Rangiputa snorkel

Margaret's careful reconnoitre of the rocky point as the sun went down showed an opportunity to snorkel during low tide at first light in the morning. Timing was critical because there are strong tidal rips close to the shore. The results of this dawn effort exceeded expectations, visibility was about 5 m. An unusual feature was a great profusion of sponges living near the surface thriving in the strong currents and lack of silt. Some of the purple finger sponges were half a metre long. Two, hoary old trumpet shells *Cabestana spengleri* and large chitons *Eudoxochiton nobilis* were attached to the rocks in depths of 3 m.

A chocolate brown and cream nudibranch *Aphelodoris luctuosa* was crawling exposed on rocks near its 60 mm diameter peachy spawn coil. The current swirled masses of large, empty *Chaetopterus* sp. tubes into the subtidal hollows.

Two parore, a large shoal of mullet, and another of koheru, a plankton feeding fish that swims in dense shimmering shoals, came to investigate the intruder. The brown algae were decorated with several bunches of squid eggs. Patches of green algae *Caulerpa brownii* waved attractively in the current. Huge sheets of ruby-red *Gigartina* competed for space, kelp *Ecklonia radiata* had luxuriant fronds. The well named comb star *Austropecten polycanthus* was hunting across the rocks.

One could become quite addicted to the five star luxury at Lyn's motor home after the snorkel, which comprised of a hot shower, tea and toasted crumpets!

Taupiri

True to form the fine wash up among rocks contained some northern species. Heather found her first *Mitra carbonaria,* though she passed over a patterned pair of *Gomphina maoria* found by Margaret (Fig. 2).

Bland Bay

Several rows of wash up at the northern end were worthy of detailed inspection, so much so that Lyn lay down to get a better view, much to the curiosity of the locals! Wentletraps *Epitonium minora* and *Boreoscala zelebori* were present in high numbers some still alive. Other small prizes included *Pupa kirki, Notocochlis migratoria, Mesoginella koma, Cylichna thetidus, Trivia merces* and *Eatoniella flammulata.* Unfortunately the specimens of *Pictobalcis articulata* and *Nassarius aoteanus* were incomplete. When shell sand was put under the microscope at home a rare micromollusc *Naricava neozelanica* was discovered (MM, Fig. 2).

Conclusion

Let's not wait for the Conchology Section centenary before we go again!

Name changes

Previous name	Updated name
Gastropods	
Archidoris wellingtonensis	*Doris wellingtonensis*
Cirsotrema zelebori	*Boreoscala zelebori*
Crepidula monoxyla	*Maoricrypta monoxyla*
Gadinia nivea	*Trimusculus conicus*
Haloginella mustelina	*Serrata mustelina*
Lepsiella scobina	*Haustrum scobina*
Marginella pygmaea	*Mesoginella koma*
Marginella valei	*Mesoginella valei*
Marginella vidae	*Cystiscus vidae*
Natica migratoria	*Notocochlis migratoria*
Nodilittorina antipodum	*Austrolittorina antipodum*
Zegalerus tenuis	*Sigapatella tenuis*
Bivalves	
Bassina yatei	*Circomphalus yatei*
Divaricella huttoniana	*Divalucina cumingi*
Periploma angasi	*Offadesma angasi*
Saccostrea cucullata	*Saccostrea glomerata*
Tellina edgari	*Tellinota edgari*

Acknowledgements

Thank you to Betty and Bob Grange for their hospitality at Houhora, Alison Stanes for travel in the motor home and accommodation at Coopers Beach, Fiona Thompson and Lyn Hellyar for additions to the species list, Ashwaq Sabaa for scanning the figures and Bruce Hayward for formatting the article.

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Northland 19 -28 Sep 2005	Houhora Heads	Rarawa	Paua	Spirits Bay	Cape Maria	Kaimaumau	Coopers Beach	Karikari	Tokerau	Rangiputa	Bland Bay	Taupiri
d=dead dd=many dead c=common												
f=frequent o=occasional r=rare												
wl=wash up live												
Polyplacophora Chitons												
Chiton glaucus										o	o	o
Cryptoconchus porosus				wl						r		
Eudoxochiton nobilis										r		
Ischnochiton maorianus							o			o	o	
Leptochiton inquinatus											o	
Onithochiton neglectus neglectus												d
Rhyssoplax stangeri				wl						d		
Sypharochiton pelliserpentis							o			f	f	d
Gastropoda												
Adelphotectonica reevi		d										
Alcithoe arabica		d										
Alcithoe arabica f.depressa		d		wl								
Alcithoe haurakiensis		d										
Alcithoe hedleyi		d										
Amalda australis		d	o			wl					d	
Amalda novaezelandiae										d	d	d
Amphibola crenata							d			d		
Antisolarium egenum						d					d	
Aphelodoris luctuosa										r		
Argobuccinum pustulosum tumidum		d		d								
Asteracmea suteri											d	d
Austrofusus glans	d	d		d		wl		d				
Austrolittorina antipodum					c		c			c	c	c
Austromitra rubiginosa											d	d
Boreoscala zelebori		d		d							wl	
Bouchetriphora pallida												d
Buccinulum linea		d		d	d	d	d					d
Buccinulum mariae												d
Buccinulum robustum												d
Buccinulum vittatum vittatum		d		d						d	d	d
Bulla angasi												d
Bulla quoyii			d	d			d			d	d	
Bursatella leachii			c									
Cabestana spengleri		d		d						r	d	
Caecum digitulum										d		
Calliostoma punctulatum	d	d		d		d					d	d
Calliostoma trigris				d								
Cantharidus opalus									d			
Cantharidus purpureus	d	d		dl		d	d			d	d	d
Casmaria perryi				d								
Cavolinia inflexa											d	
Cellana ornata		d		d		o					o	d
Cellana radians		d		d	d	o					c	d
Cellana stellifera		d		d			d				d	d
Charonia lampas		d		d		wl						
Chemnitzia sp.										d	d	
Clanulus peccatus				d								d
Cominella adspersa	d	d		wl			d		d	o	d	

Northland 19 -28 Sep 2005	Houhora Heads	Rarawa	Paua	Spirits Bay	Cape Maria	Kaimaumau	Coopers Beach	Karikari	Tokerau	Rangiputa	Bland Bay	Taupiri
Cominella glandiformis		d	c				d					
Cominella maculosa		d	o								o	d
Cominella quoyana quoyana		d		d			d			d	d	d
Cominella virgata		d		d								o
Cookia sulcata		d		d			d				d	
Crosseola vesca											d	
Cumia reticulata											d	
Cylichna thetidus											d	
Cymatium exaratum		d		d								
Cymatium parthenopeum		d	r	d		d					d	
Cystiscus vidae											d	
Dentimargo cairoma											d	d
Dicathais orbita		d		d			d					d
Diloma bicanaliculata							d			d		
Diloma subrostrata			c				d			d	d	
Diloma zelandica							r					
Doris wellingtonensis				wl								
Eatoniella albocolumella					o							
Eatoniella flammulata											d	d
Eatoniella limbata					r							
Eatoniella olivacea										d		d
Eatonina atomaria												d
Eatonina subflavescens					o							
Emarginula striatula					d						d	d
Epitonium jukesianum											d	
Epitonium minora				d		d				d	wl	
Epitonium tenellum										d	d	
Fictonoba carnosa												d
Fictonoba rufolactea												d
Fossarina rimata										d	d	
Haliotis iris		d		d							d	
Haliotis virginea crispata				d			d				d	d
Haloginellla cf. *maoriana*												d
Haminoea zelandiae			o								d	
Haustrum haustorium		d		d			d				d	
Haustrum scobina							c			c	c	c
Herpetopoma bella							d				d	d
Janthina exigua											d	d
Lamellaria ophione						d					d	
Leuconopsis obsoleta										d		
Macrozafra subabnormis												d
Maoricolpus roseus roseus		d					c				d	
Maoricrypta costata		d		d		d	d			d	d	d
Maoricrypta monoxyla				wl						d	d	d
Maoricrypta profunda				d			d				d	d
Maoricrypta sodalis				wl							f	d
Melagraphia aethiops							c				c	d
Melanochlamys lorrainae			r							**d?**		
Merelina compacta											d	
Merelina crosseaformis												d
Merelina taupoensis												d
Mesoginella koma				d		d				d	dd	dd

Northland 19 -28 Sep 2005	Houhora Heads	Rarawa	Paua	Spirits Bay	Cape Maria	Kaimaumau	Coopers Beach	Karikari	Tokerau	Rangiputa	Bland Bay	Taupiri
Mesoginella valei				d								
Micrelenchus dilatatus											d	d
Micrelenchus rufozona						d					d	
Micrelenchus sanguineus											d	d
Mitra carbonaria											d	d
Modelia granosa		d							d		d	d
Monodilepas diemenensis					d							
Muricopsis mariae	d	d		d							d	d
Muricopsis octogonus		d										d
Naricava neozelanica											d	
Nassarius aoteanus											d	d
Nassarius spiratus											d	
Natica lemniscata											d	
Neoguraleus lyallensis tenebrosus											d	d
Neoguraleus murdochi							d				d	d
Nerita atramentosa							c				c	c
Notoacmea elongata											d	
Notoacmea helmsi			f							d	d	
Notoacmea parviconoidea					*o*							
Notoacmea scopulina											d	d
Notoacmea subtilis											d	
Notocochlis migratoria				d							d	
Nozeba emarginata										d		
Onchidella nigricans							*o*					
Ophicardelus costellaris						d						
Paratrophon quoyi						d					d	d
Patelloida corticata							0					d
Peculator hedleyi												d
Pelicaria vermis				d			d		d			
Penion cuvieranus		d										
Penion sulcatus		d		d								
Pervicacia tristis				d							d	
Phenatoma rosea		d										
Philine angasi			r									
Philine powelli										d		
Pictobalcis articulata												d
Pisinna semiplicata												d
Pisinna zosterophila					c							d
Polinices simiae												d
Potamoprygus antipodarum										d		
Pupa kirki				d							dd	
Pusillina hamiltoni											d	
Ranella australasia		d	*o*	d		wl						d
Rastodens puerilis					r							
Risellopsis varia										d	d	
Rissoella flemingi ?					r							
Rissoella sp.					r							
Rissoina chathamensis											d	d
Sassia parkinsonia			r									
Scutus breviculus												
Seila terebelloides												d
Semicassis labiata				wl								

Northland 19 -28 Sep 2005	Houhora Heads	Rarawa	Paua	Spirits Bay	Cape Maria	Kaimaumau	Coopers Beach	Karikari	Tokerau	Rangiputa	Bland Bay	Taupiri
Semicassis pyrum		d		d								
Semicassis sophia				d								
Serpulorbis sp.										d		
Serpulorbis zelandica				wl								
Serrata mustelina												d
Sigapatella novaezelandiae		d		wl	d		d				d	
Sigapatella tenuis		d		dl		d				d	d	d
Sigapatella terraenovae					d							
Siphonaria australis					d						d	d
Striodostomia orewa										d		
Struthiolaria papulosa		d		d		d	d		dd		d	
Tanea zelandica		d		d							d	d
Taron dubius							d					d
Tenagodus weldii											d	
Thoristella oppressa										d	d	d
Tonna cerevisina	d	d		dl								
Trichosirius inornatus												d
Trimusculus conicus												d
Trivia merces											d	d
Trochus tiaratus						d					d	
Trochus viridis		d		d			d				d	d
Tugali elegans												
Tugali suteri											d	d
Turbo smaragdus		c								c	c	c
Volutomitra obscura				d							d	d
Xymene ambiguus		d		d		dd			wl			
Xymene plebeius										d		
Xymene traversi											d	d
Zeacolpus pagoda pagoda		d		d							d	d
Zeacumantus lutulentus			c									
Zeacumantus subcarinatus										d	d	o
Zemitrella choava											d	d
Zemitrella fallax												d
Zethalia zelandica		dd		dd		dd	dd			d	dd	d
Bivalvia												
Anadara trapesia				d								
Anomia trigonopsis		d					d			d		
Arthritica bifurca										d		
Atrina zelandica		d	r							d		
Austrovenus stutchburyi			c	d			d					
Barbatia novaezelandiae		d		d			d					d
Barnea similis							d			d		
Cardita aoteana				d							d	d
Cardita brookesi											d	d
Circomphalus yatei		d	d				d					
Cleidothaerus albidus				d								
Corbula zelandica							d				d	d
Crassostrea gigas										c		
Diplodonta striatula											d	
Divalucina cumingi		d		d	d	d	d			d	d	
Dosina crebra				d				d				d
Dosinia anus									d			

Northland 19 -28 Sep 2005	Houhora Heads	Rarawa	Paua	Spirits Bay	Cape Maria	Kaimaumau	Coopers Beach	Karikari	Tokerau	Rangiputa	Bland Bay	Taupiri
Dosinia maoriana				d	d							d
Dosinia subrosea				d			d	d			d	
Felaniella zelandica				d	d		d				d	
Gari convexa				d							d	
Gari lineolata				d						d	d	
Gari stangeri				dl	d						d	d
Glycymeris modesta		d		d	d		d					d
Gomphina maorum					d							d
Hiatella arctica		d								d	d	d
Irus elegans												
Irus reflexus												
Leptomya retiaria							d					
Limaria orientalis												
Limatula maoria		d		d	d						d	
Macomona liliana		d	d				d					
Mesopeplum convexum				dl								
Modiolarca impacta										d	d	d
Modiolus areolatus		d			d						d	d
Musculista senhousia										d		
Myadora boltoni											d	
Myadora striata	d	d		d				d				
Myllita stowei											d	d
Myllitella vivens										d		
Myochama tasmanica										d		
Neolepton antipodum											d	
Notoacmea parviconoidea					o							
Notocallista multistriata		d										
Nucula hartvigiana							d			d	d	
Nucula nitidula											d	
Offadesma angasi												
Ostrea chilensis				d	d						d	
Oxyperas elongata				dl								
Panopea zelandica				dl								
Paphies australis			d				d					
Paphies subtriangulata	d	d			d		d			d	d	
Pecten novaezelandiae				dl								
Perna canaliculus												
Peronaea gaimardi	d						d					
Philobrya cf. *modiolus*										d		
Philobrya munita										d		
Pleuromeris zelandica											d	
Protothaca crassicosta		d									d	
Pseudarcopagia disculus		d		d							d	d
Ruditapes largillierti	d	d					d		d	d	d	
Saccostrea glomerata		c					c					d
Scalpomactra scalpellum											d	
Scintilla stevensoni											d	
Solemya parkinsonii			d			d						
Soletellina nitida				d							d	
Talochlamys zelandiae		d		dl	d						d	d
Tawera spissa		d		dd	d	d					d	d
Tellinota edgari							d					

Trichomusculus barbatus						d				d	d	
Tucetona laticostata	d	d		dl		d			d			
Venericardia purpurata		d		dl			d				d	
Venericardia reigna					d							
Xenostrobus pulex		c					c			c	c	c
Zelithophaga truncata										d		
Zenatia acinaces			d				d					
Scaphopoda												
Fissidentalium zelandicum					d							
Cephalopoda												
octopus indet.											r	
Spirula spirula	d	d			d							
squid eggs										c	r	
Brachiopoda												
Calloria inconspicua				d							d	d
Echinodermata												
Astropecten polycanthus comb star										r		
Echinocardium cordatum heart urchin										d		d
Evechinus chloroticus kina		d										
Ophiopsammus maculata oar star				wl								
Crustacea												
Austrominius modestus modest barnacle										c		
Balanus trigonus				wl						d		
Epopella plicata												o
Eurynolambrus australis				wl								
Notomithrax sp.				wl								
Petrolisthes elongata half crab							c					
hermit crabs- large red				wl								
Ascidians												
compound ascidian ochre yellow				wl								
indet. sheets				wl						o		
Coelenterata												
Actinia tenebrosa red anemone							o					
Actinothoe albinocincta yellow anemone										o	o	
Isocradactis magna							o			o		
hydroids				wl						c		
bryozoans				wl						c		
Porifera												
Callyspongia ramosa				wl						f		
Clione celata yellow encrusting sponge				wl						o		
Siphonchalina sp. organ pipe sponge				wl						o		
Tethya aurantium golf ball sponge				wl						o		
purple finger sponge				wl						f		
red lobed sponge				wl						f		
Polychaetes												
Chaetopterus sp. leathery worm										dd		
Spirorbis					c					c		
Algae												
Caulerpa brownii				wl						c	o	
Durvillaea antarctica					f							
Ecklonia radiata				wl						c		
Hormosira banksii										c		
Lessonia variegata											o	
Lithophyllum carphophylli				wl						o		
red algae spp.				wl						f		
Zostera sea grass			c									

Spirits Bay

Margaret S. Morley

In September 2005 following the 75 weekend celebrations of the Conchology Section, several members collected in Northland including Spirits Bay where there was a massive wash up (Morley and Smith this journal). At the time we felt that every shell that lived there had been washed ashore, of course this was not the case as a second visit on 15 December 2005 proved. This species list for Spirits Bay records 90 additional species to those in the Northland article, 1 chiton, 67 gastropods, 21 bivalves, 1 cephalopod and 1 echinoderm.

Some torrential rain the week before caused the creek to the east of Pananehe Island to break through the beach sand barrier and drain directly across the beach. the water level in the lagoon near the start of the track to the beach was noticeably lower than that observed previously. These changes had carved a vigorous stream bed across the beach leaving the normally clear water in the bay a turgid brown. Back eddies had left a fine wash up around the large boulders near high tide. A couple of handfuls of the fine wash up on the beach were very rich in microscopic species.

The lower water level made it easy to wade up the creek, tightly packed mats of the estuary mussel, *Xenostrobus securis* previously under the water had died in life position on the rocks. The gastropod *Zemelanopsis trifasciata* had not suffered the same fate and was common crawling on the creek bed. Some of the oysters had died too. I expected these to be *Crassostrea gigas* as this species lives in a similar estuarine habitats e.g. Piha but the chomata along the hinge margin proved them to be *Saccostrea glomerata.*

The big surf did not allow a detailed low tide search. The sand washed down by the creek has been deposited across the spit to the island, largely engulfing the rocky reef and its tidal pools with sand. Much time was spent looking for *Morula* under big boulders and in the wash up to no avail.

A third article could further extend the species list for Spirits Bay if a visit coincides with suitable conditions for collection of low tide algae and rock wash. Of course there may be another wash up!

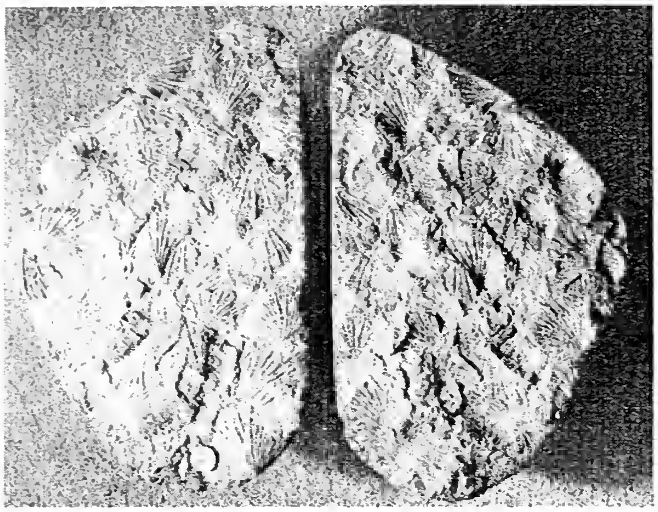
Heads down, bottoms up, sorting the collection from the Northland trip.

Spirits Bay 15 December 2005	DEAD	LIVE
d=dead, c=common, f=frequent, o=occasional, r=rare		
PLACOPHORA		
Plaxiphora caelata		r
GASTROPODA		
Amalda mucronata	d	
Amphithalamus falsestea	d	
Antisolarium egenum	d	
Aplysia parvula	d	
Asteracmea suteri	d	
Austrolittorina antipodum		f
Cantharidella tesselata	d	
Chemnitzia spp.	d	
Crassitoniella carinata	d	
Cylichna thetidis	d	
Diloma nigerrima	d	
Eatoniella albocolumella	d	
Eatoniella flammulata	d	
Eatoniella notalabia	d	
Eatoniella mortoni	d	
Eatoniella olivacea	d	
Eatoniella roseola	d	
Eatoniella roseospira	d	
Epitonium jukesianum	d	
Fictonoba carnosa carnosa	d	
Fossarina rimata	d	
Haustrum scobina		o
Linopyrga rugata rugata	d	
Liratilia elegantula	d	
Liratilia subnodosa	d	
Macrozafra enwrighti	d	
Macrozafra subabnormis	d	
Merelina lyalliana	d	
Merelina crassissima	d	
Merelina taupoensis	d	
Micrelenchus rufozona	d	
Micrelenchus sanguineus	d	
Mitra carbonaria	d	
Notoacmea elongata	d	
Notoacmea pileopsis pileopsis	d	
Notacmea subtilis	d	
Nototriphora aupouria	d	
Onoba candidissima	d	
Patelloida corticata	d	
Pisinna olivacea impressa	d	
Pisinna semiplicata	d	
Pisinna zosterophila	d	
Potamopyrgus antipodarum	d	
Potamopyrgus pupoides	d	
Pseudoestea crassiconus	d	
Pseudomalaxis zanclaeus meridionalis	d	
Pupa affinis	d	
Pusillina hamiltoni	d	
Pusillina infecta	d	

Retusa oruaensis	d	
Risellopsis varia	d	
Rissoella flemingi	d	
Rissoella micra	d	
Rissoella rissoaformis	d	
Rissoina chathamensis	d	
Rissoina fucosa	d	
Serpulorbis sp.	d	
Stephopoma rosea	d	
Synthopsis caelata	d	
Tarou dubius	d	
Tenagodus weldii	d	
Trichosirius inornatus	d	
Xymene traversi	d	
Zemelanopsis trifasciata		c
Zemitrella choava	d	
Zemitrella fallax	d	
Zemitrella laeviros tris	d	
BIVALVIA		
Cardita brookesi	d	
Cosa laevicostata	d	
Cosa serratocostata	d	
Gaimardia finlayi	d	
Hiatella arctica	d	
Irus elegans	d	
Irus reflexus	d	
Kidderia costata	d	
Kidderia aupouria aupouria	d	
Lasaea hinemoa	d	
Lasaea maoria	d	
Modiolarca impacta	d	
Myllitella vivens vivens	d	
Neolepton antipodum	d	
Nucula certisinus	d	
Philobrya acutangula	d	
Philobrya cf. *modiolus*	d	
Philobrya munita	d	
Saccostrea glomerata		f
Scalpomactra scalpellum	d	
Xenostrobus securis		c
CEPHALOPODA		
Spirula spirula	d	
ECHINODERMATA		
Evechinus chloroticus	d	

THE TWIN HALVES STORY

By Heather Smith



A truly magnificent rock aged around 200 million years old, covered in imprint images of Monotis, a pecten-like shell, sits beside Margaret Morley's fireplace. It was acquired on a research excursion to Kiritehere Beach west of Waitomo. Bruce Hayward selected the rock, whacked it open, and whippee, there were the fossil imprints, like patterns on a wall paper, completely covering each surface. Bruce carried one half over a kilometre down the beach to the carpark. Margaret struggled with the other half, eventually with great disappointment, leaving it up in the sand dunes. Bruce kindly returned and collected if for her.

One week after viewing this specimen my twin sister and I were heading to Kiritehere. We parked beside the bridge with the panoramic views and set out trekking south across the beach and down the rugged coastline. We viewed the Monotis seam and questioned how would we ever open one of those rocks let along carry it back to the van. We continued our journey of exploration on this rugged coastline, studying more ancient seams of mussel fossils. Further south we rounded a headland and found a large inviting rocky swimming hole. On a clear warm sunny day in May we cooled off despite the lack of togs and towels.

Four hours later we returned to the Monotis seam to find a perfect rock specimen recently opened, laying, waiting just for us. Well, somebody had opened it in our absence. What about the carrying? While we stood in awe admiring it a man appeared from behind a rocky outcrop. He had just split this rock open and taken the other half to his four wheel drive parked handy on the beach. If we would like this half he would be happy to carry it to his four wheel drive and drop it off back at the carpark. We accepted eagerly. His wagon was jammed with surf boards, wetsuits, loose tired clothing items, rocks, tools, gumboots, soggy towels and all the junk of a mid-life gypsy surfer. Waving caution to the wind, my sister squeezed into the front passenger sea to accompany this stranger down the beach. There was no room for me so I was left to walk. At least she has a rock hammer and a small mallet in her bag I thought to myself as the wagon disappeared in the distance. Half an hour later I was pretty relieved to see her walking down the beach to meet me.

John lived in Kawhia an hours drive away. He owned a property of 40 acres just above those rugged cliffs and headlands we had been walking around earlier and oh! Yes! He'd seen our figures way down on the beach earlier in the day, walking figures not swimming we hoped!

At dawn next morning a four wheel drive pulled up beside our motor home. "Gracious! He's keen," says my sister as she draws back the curtain. He has especially returned early in order not to miss us. "I've brought you the other half of that rock," he calls. "I think they should be together. Besides, I can get another one any time."

We were overwhelmed with his generosity! Our fireplace is graced with two matching rock specimens and we didn't have to smack, whack or carry our rocks!

P.S. Margaret, where did you say you got that perfect ammonite from?

A NEW SHELL FOR KAIKOURA

By Bev Elliott

On August 30th, 2004 I was beach-cleaning near the New Wharf at Kaikoura, when I was astounded to find a shell that I had never seen before, a large white file shell, family *Limidae*. I thought I knew where it had come from, as other species found on this little beach include thin green *Perna canaliculus,* which look very different to their tough little cousins which live here and large *Crassostrea gigas,* and the pod valves of *Pecten novaezelandiae,* neither of which live around here. Were the seafood specialists of Kaikoura now importing foreign *Lima* to add to the delicacies offered to the tourists? I hastened to the nearby fish shop to find out. Fay assured me that my shell was not a foreign import. She was as surprised as me to learn that I had picked it up on the beach as I was to learn that a fisherman had brought in a living specimen which Fay kept for a while in the tank of a live crayfish in the fish shop.

She mentioned its apricot colouring; (the animal, I presume, as my shell is white), and that it had been handed on to the marine lab. I hastened to the marine lab and talked with Jack van Berkel. The file shell had been handed on to someone in Christchurch, who had identified it as *Acesta*.

That jogged my memory, as a while ago Michael Eagle had identified a large fossil at Kaikoura Museum as an *Acesta.* So I was able to spell the name for Mr van Berkel, and also to show him in his copy of Suter's Manual which family it belonged to.

He didn't have any other details that he could give me, but said he would be in touch if/when he received any more information from his contact in Christchurch.

Next stop was the Kaikoura Museum, to which I was already heading for my voluntary work there, and straight to the cabinet where the big *Acesta* fossil is kept.

Acesta is a very featureless shell, with no sculpture except for some very faint ribs towards one edge. It is smooth and white, and my specimen has a bit of golden-brown epidermis around the edge. The interior is smooth, white and glossy. The valves were joined at the hinge, but most of the second valve is missing.

I rang the fisherman I'd been told was the donor of the living shell, but he knew nothing about it. He gave me two other names to try, both of whom knew nothing about it, but the second man recognised my description of the shell, and gave me some interesting information.

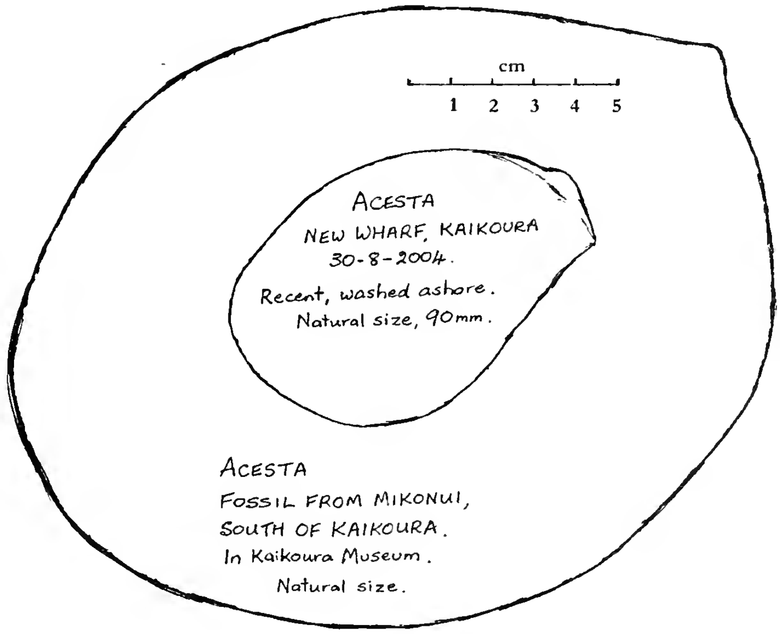
They are caught in nets 10 miles off Kaikoura in about 200 fathoms/500 metres. The size is about three inches and the colour pinkish. I presume that means the animal, as there is no trace of any colour on my shell, and it is so thin that the colour from the animal would be likely to show through.

And what do fishermen do with them? Throw them right back overboard!!! It seems it never occurred to them that somebody might be interested in them.

So if you want one of these treasures of the deep for your collection, just come down to Kaikoura, swim out 10 miles, and dive down to 500 metres!

Spencer and Willan list this shell as *Acesta sp.* Dell 1978 An*. It should be possible to add a C to the location now.

It is hoped that there will be a sequel to this article as more information comes to hand.



A CHLAMYS FROM MOERAKI

By Jim Rumbal

Scenario:

A Moeraki fishing boat battling through a choppy sea lost a cray pot overboard. The steel mesh pot, with a large plastic buoy and coiled rope inside, sank to the bottom in ten to twelve metres of water .There it sat, to be invaded by marine life for perhaps a couple of seasons. The pot was then fouled by another fisherman and brought to the surface, to be returned to the end of the Moeraki wharf, abandoned and waiting to be claimed by its owner.

Scene One

A holidaying shell collector strolling in the early morning sun noticed the rusty, dry seaweed encrusted pot and looked inside. The large buoy and coiled rope were still enclosed and covered with drying slimy marine algae. But what's this! Two large ribbed red brachiopods! These were quickly plucked from the rope where they were attached and into the collecting bag. Then a nice large swollen triton with complete velvety periostracum. Next, amongst the strands of weed on the buoy, a small Chlamys, then another, and several more attached by their byssal threads to the rope! They were prettily mottled in shades of brown pink and orange. one with white ribs with dark brown interstices. But they were different from other Chlamys that the collector was familiar with! Almost with the sculpture of Dichroa, but not that species. They appeared in shape to be dieffenbachi, but - they were different!

Scene Two

A cold winters evening at home sitting in front of the fire studying Powell. The descriptions and illustrations did not match the Chlamys collected at Moeraki. Further browsing through back numbers of Poirieria and an excellent article on Chlamys by the late Norm Gardener, and then BINGO! There it was, a description of the very Chlamys in question. To quote from Poirieria, July 1970, Volume 5, Part 4. "Chlamys suprasilis [Findlay 1928] - but this species not now generally recognised. - considered by Beu [1965] to be the phenotype assumed by dieffenbachi when it lives under much less enclosed conditions" The prominent rounded ribs are not spinosely ornamented, but have sparse, rounded scales across the ribs. This fitted the specimens perfectly. I had a name for the Chlamys.

The cray pot had produced:

* 2 large red ribbed brachiopods, Margasella sanguinea, 38 and 40mm across.
* 1 nice Swollen Triton, Argobuccinum pustulosum tumidum, 82 mm long, with complete velvety periostracum.
* 19 Chlamys suprasilis, the largest 21mm across.

NAME CHANGES

Margaret Morley's excellent synopsis of the name changes from Powell {1979} to Spencer and Willan {1996} has been most helpful. Chlamys have had many changes, and Chlamys suprasilis is no exception, even if it is recognised only as "a phenotype of C.dieffenbachi".

Chlamys zelandiae Gray 1843 now covers all of the below forms:
Pecten dieffenbachi Reeve 1853 = Chlamys celatior Findlay 1928 =
Chlamys dieffenbachi Dell 1963
Chlamys suprasilis Findlay 1928. Phenotype assumed by C. dieffenbachi when living under less enclosed conditions.
Chlamys zelandona Hartlien 1931

As a keen amateur collector of shells, I like to name them, separating them from their close family members, even if by strict nomenclatural rules these names are invalid. Otherwise how could I separate my round ribbed, broad scaled C. zelandiae [suprasilis phenotype form] from the distinctively differing spiculately ribbed C. zelandiae forms as shown in the illustrations.

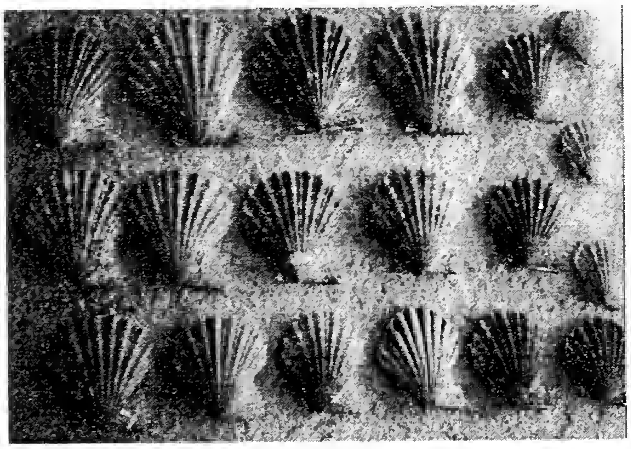


Photo 1: Chlamys zelandiae [suprasilis form] Specimens from the Moeraki cray pot.

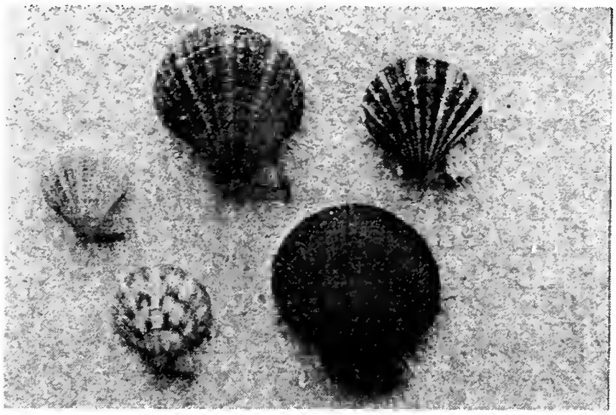


Photo 2: Top left: Chlamys zelandiae zelandiae Matauri Bay
Top middle Chlamys zelandiae [dieffenbachi form] Ringa Ringa Beach Stewart Island.
Top right Chlamys zelandiae [zealandona form] Marfells Beach Marlborough.
Bottom left Chlamys gemmulata gemmulata Reeve 1853 Bay of Plenty
Bottom right Chlamys gemmulata radiata Hutton 1873 Paterson Inlet, Stewart Island.

The Moeraki weekend was most enjoyable, even more so with the finding of this uncommon Chlamys form. What other interesting shells are to be found there?

Molluscs and Ostracods in a tidal transect from Whangapoua Estuary, Coromandel Peninsula

Margaret S. Morley and Bruce W. Hayward

This study aims to document the habitat and depth range of intertidal and shallow subtidal mollusc and ostracod species in the central portion of the Whangapoua Estuary. An improved knowledge of the tidal range of shelled species in sheltered harbour and estuarine environments will be of value in inferring the tidal elevation at which fossil Holocene (0-10,000 yrs old) assemblages once accumulated. This is particularly useful in studies of sea-level change and also in earthquake-prone areas where the land may have been uplifted or subsided during major earthquakes (e.g., Goff et al., 2000; Hayward et al., 2004). The tidal range of foraminifera in these environments is now relatively well documented (e.g. Hayward et al., 1999a, b) and adding two further groups will be valuable additions to paleoecologists' tool box.

In this study we record a diversity of 29 species of mollusc (11 gastropods, 18 bivalves) and 39 species of ostracod, but not all of them were in-situ living specimens.

Transect and sample processing

The transect was taken in July 2000 near the Whangapoua wharf, east coast Coromandel Peninsula, adjacent to the main harbour channel (Fig. 1). Sediment residues and faunal slides will be deposited in the collections of the Geology Department, University of Auckland (AU17600-17608). Samples of 20 cc of sediment were taken at 0.2 m elevational intervals from mid tide level at 1.1 m (above spring low tide level) to -0.1 m, with two subtidal samples in the main channel from -1.5 and -3 m below spring low tide level. The spring tidal range here is ~1.8 m.

Sediment samples were washed over a 63 µm sieve to remove mud, then dried. For our ostracod and mollusc studies, only the size fraction larger than 125 µm was examined. All identifiable mollusc shells or broken shells were identified and counted, noting specimens that were living when collected. With ostracods all single (dead) valves were picked and counted separately from all articulated double valves (usually living). Where high numbers of ostracod shells were present, only a ½ or ¼ split of these samples was picked and the numbers multiplied up to equal a full 20 cc sample.

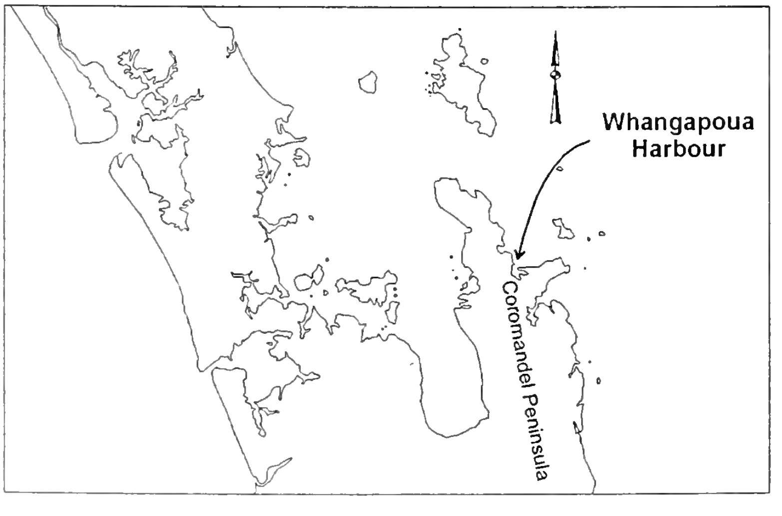


Fig. 1 Location of Whangapoua Harbour, Coromandel Peninsula in northern New Zealand.

Ostracoda

Ostracoda is a class of the Subphylum Crustacea. Ostracods could be called water fleas, but since most are less than a millimeter in size, this common name is unlikely to become popular. They have a superficial resemblance to bivalves having a hinge and two valves, but the shrimp-like animal inside has paired appendages and limbs (Fig. 2). The eyes see through a smooth convex patch on the valves called the eye tubercle. The animal is permanently attached inside the valves, the raised muscle scar pattern on the inside of the valves is significant for species identification.

Taxonomists use the detail of the animal for identification, e.g. the number and features of the podomeres, or segments of the appendages. However the shape and ornamentation of the valves is also a valuable aid to identification (Yassini and Jones, 1995), and the valves are the only parts that survive after death and are fossilised.

Ostracods scavenge along the sea floor in vigorous bursts of movement with frequent changes of direction. At the slightest disturbance the appendages are withdrawn and the valves closed. Some animals are pink, some pale, others black, the colour of the animal can be seen through the valves and is consistent within each species. A microscope is needed to observe ostracods from local beaches. To find ostracods sieve the sediment washed from intertidal seaweeds - *Corallina officinalis* is a rich habitat, but just a sample of muddy sand will do.

Ostracods live in a range of habitats from deep marine to fresh water and a few even live on land (Moore, 1961). Many of the deep-water species are blind, as sight is of no use in the pitch dark. A few pelagic species live in the plankton, where to avoid predators the best camouflage is to be transparent.

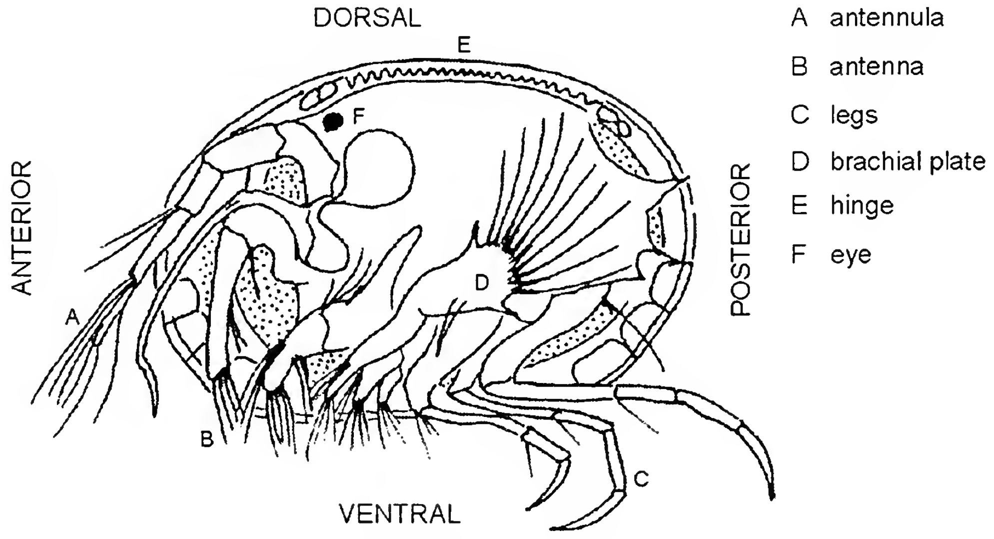


Fig. 2 Anatomy of a generalized ostracod, with one valve removed.

Previous work on New Zealand Ostracoda

One of the first contributions to the knowledge of New Zealand living ostracods was made by Thomson (1879) in which he describes nine species. Brady (1880) studied ostracods from the ocean floor around the world and included a number from samples around New Zealand. Subsequent workers include Chapman (1906), Hornibrook (1952, 1955), Swanson (1979a, b, 1980), Ayress et al. (1997), Eagar (1999), Hayward (1981, 1982) and Guise (2002). Over 600 living species of ostracods have been recorded from New Zealand (Eagar, 2005).

Identification of Ostracoda

The identification of the species in this article is provisional and will need some revision when more is known about our estuarine ostracods. The reasons for this are:

1. There are few previous studies on intertidal or estuarine ostracods in New Zealand to provide reference material.
2. Some specimens are likely to be undescribed species (Jane Guise pers. comm.).
3. Identifications have been done using valve features rather than animal anatomy, which preferably requires use of a scanning electron microscope (SEM).
4. During growth ostracods moult nine times. The early stages have different features to fully adult specimens. During its life time, each ostracod produces 18 valves.
5. In some species there is a marked difference between males and females and these may not have been recognised as just one species. Females are larger and longer than males. In some species the valves of females are expanded at the posterior end to accommodate eggs.

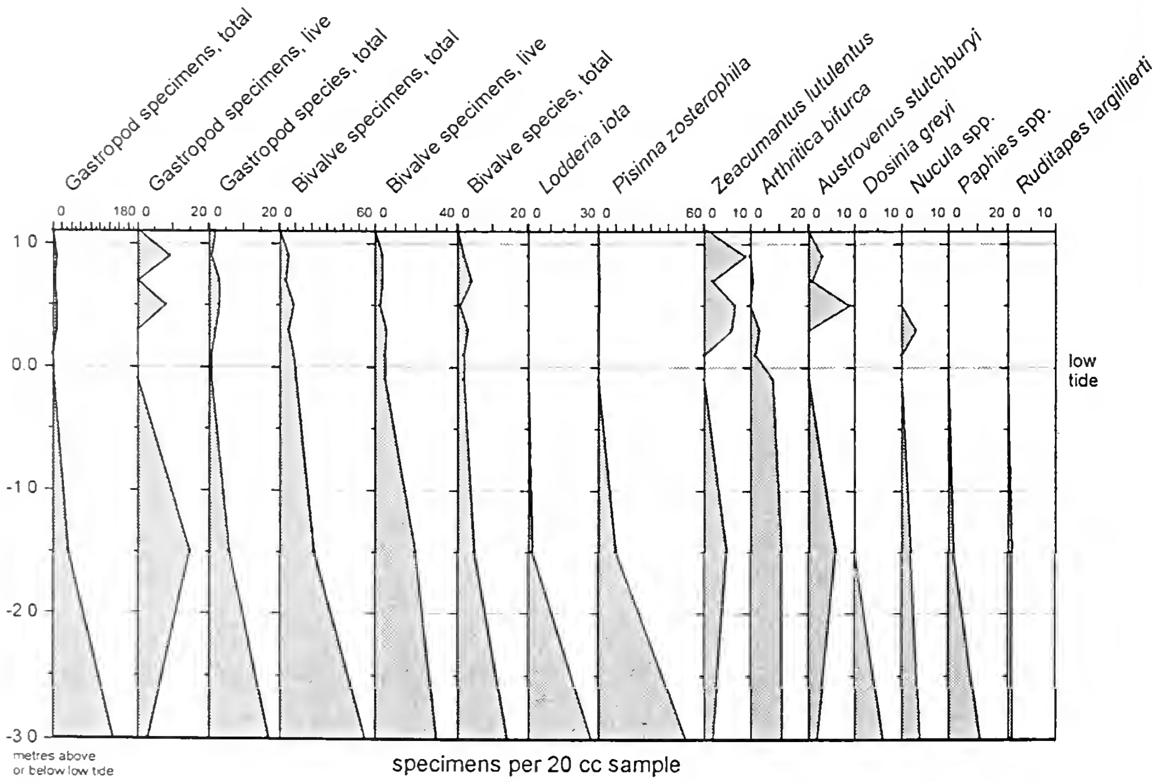


Fig. 3 Distribution of molluscan specimens and species through the subtidal to intertidal Whangapoua transect.

Observed zonation of Mollusca (Fig. 3)

With the microgastropods it was not always possible to determine which specimens were alive and which were dead when they were sampled. By far the largest number of gastropods (127 specimens) and highest diversity (17 species) was found in the centre of the main channel at 3 m depth (Appendix 1, Fig. 3), and most of these were probably carried in here by strong tidal currents. The only gastropod showing a significant mid-tidal acme of abundance was *Zeacumantus lutulentus* (Fig. 4). A single live olive shell *Amalda australis* was present at spring low tide level. Numerically the most abundant gastropods present were the microscopic *Pisinna zosterophila* and *Lodderia iota* (Figs. 3, 4), largely found in the centre of the channel where they are believed to have been swept into by currents.

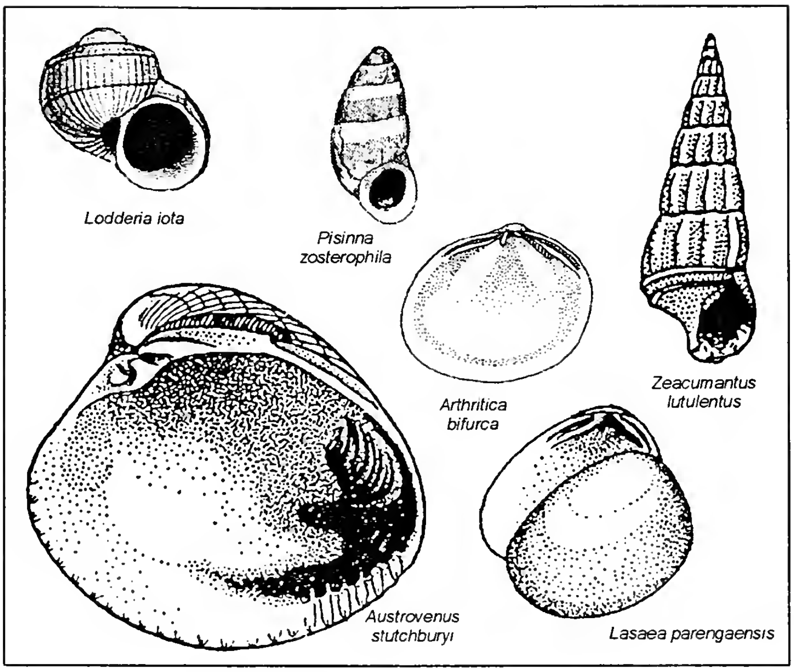


Fig. 4 Drawings (by MSM and Powell, 1979) of common and noteworthy molluscs in the Whangapoua transect.

Double-valved (probably living) cockles, *Austrovenus stutchburyi* (Fig. 4), were present from mid tide down to subtidal (0.9 to -1.5 m). Most of the common microbivalve *Arthritica bifurca* live subtidally and in the low tide zone (0.3 to -3 m), but one specimen was present as high as 0.7 m (Fig. 3). Double-valved nut shells *Nucula* were only present at low tide level (0.3 m). Juvenile double-valved specimens of *Ruditapes largillierti*, *Dosinia greyi*, pipi *Paphies australis* and tuatua *P. subtriangulata* were all found only at subtidal depths in this study (-1.5 and -3 m). In this transect the wedge shell *Macomona liliana*, which can be dense at intertidal elevations in many localities, was virtually absent with only a single double-valved specimen in the mid tide zone (0.7 m).

Observed zonation of Ostracoda (Fig. 5).

Whole specimens and single valves are recorded separately (Appendix 2). It is assumed that whole specimens were either alive at that depth or close to it, whereas single valves could have been transported some distance from where they were living by wave or most likely by strong tidal current action.

The total number of ostracod specimens (Fig. 5) was lowest at mid tide level (~1 valve per cc sediment), and increased to a peak at mean low tide (30 valves per cc) and was moderately high throughout the low tidal and shallow subtidal zone (>10 valves per cc). The total number of ostracod species (Fig. 5) was also lowest at mid tide (9-12 species) with a maximum subtidally up to extreme spring low tide level (16-22 species). All the common species present have a more articulated double valves over single valves, which suggests that they were more or less in-situ, and that there is less current transport of ostracods than molluscs. A number of ostracod species seem to exhibit a tidal elevation-influenced zonation of both double-valved specimens and total valves (Fig. 5):

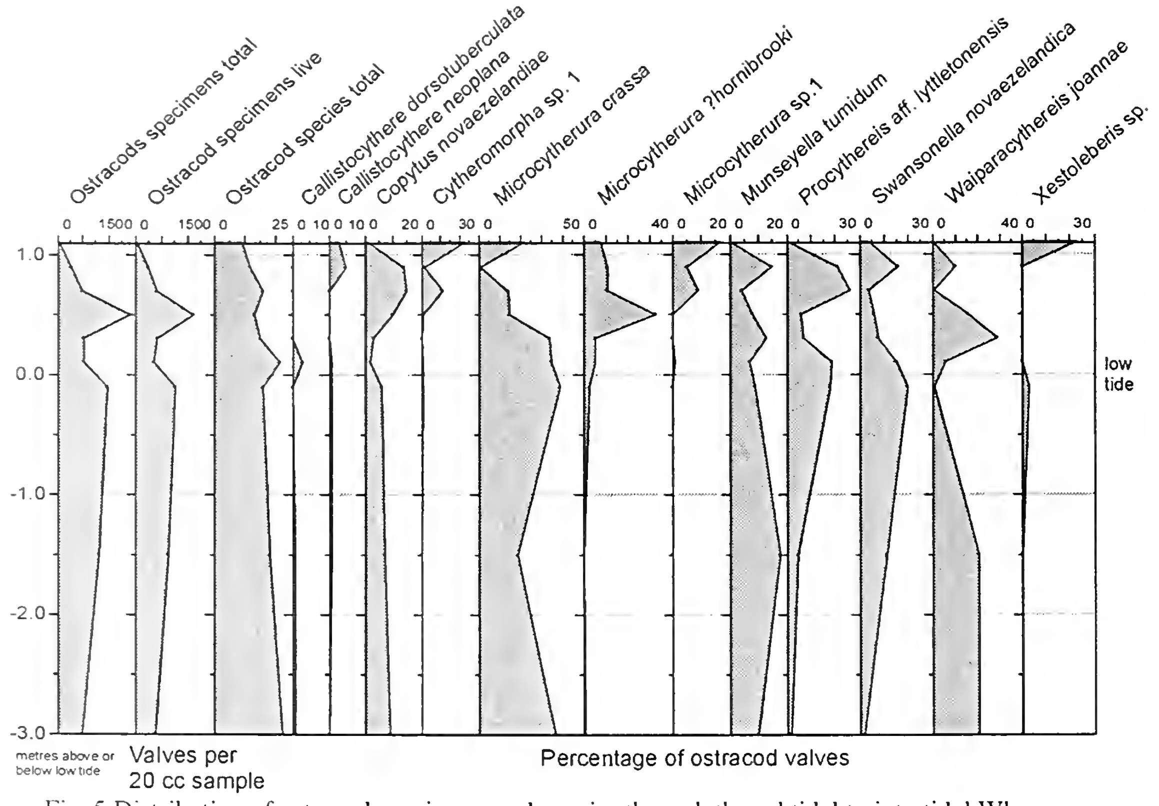


Fig. 5 Distribution of ostracod specimens and species through the subtidal to intertidal Whangapoua transect.

Callistocythere neoplana (Fig. 6) has an acme in the shallow subtidal from 0.1 to -1.5 m (Appendix 2).

Copytus novaezelandiae (Fig. 6) occurs throughout the transect, with a wide acme zone from 0.7 to -1.5 m.

Cytheromorpha sp. 1 (Fig. 6) from mid tide to just below spring low level (1.1 to -0.1 m), with an acme at neap low tide level (0.5 to 0.7 m).

Microcytherura crassa (Fig. 6) occurs throughout the transect, with greatest numbers at 0.1 m.

Microcytherura ?hornibrooki (Fig. 6) occurs throughout the transect, but with low numbers at mid tide (1.1 m) and in the subtidal channel. An acme occurs at neap low tide level (0.5 to 0.7 m).

Microcytherura sp. 1 has small numbers throughout the intertidal section, with an acme of total and live specimens at neap low tide level (0.7 m).

Munseyella tumidum and *Callistocythere dorsotuberculata* (Fig. 6, Appendix 2) have a broad acme zone from 0.5 to -3 m.

Procythereis cf. *lyttletonensis* (Fig. 6) also occurs throughout the transect with low numbers at mid tide and in the subtidal channel, with a broader acme zone between 0.9 and -0.1 m.

Swansonella novaezelandica (Fig. 6) has an acme zone between 0.3 and -1.5 m.

Waiparacythereis joannae (Fig. 6) occurs at mid tide (0.9 m) and below with an acme zone extending from low tide to the centre of the channel (0.5 to -3 m).

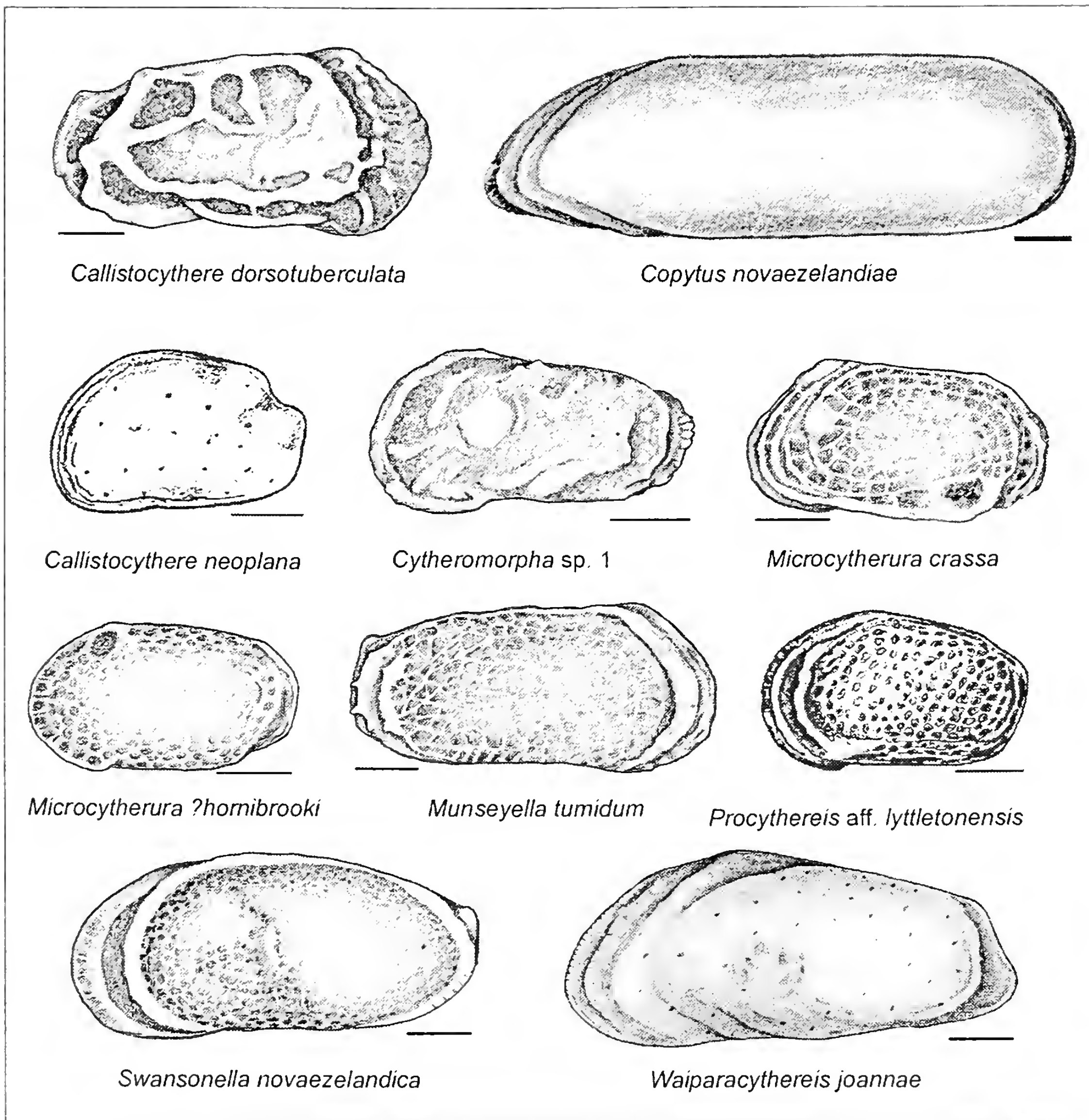


Fig. 6 Drawings (by MSM) of common ostracods in the Whangapoua transect. Scales = 0.1 mm.

Notes on Mollusc occurrences (Fig. 4)

<u>Gastropods</u>

The small gastropod *Lodderia iota* is usually found in low numbers among rocks (MSM pers. obs.). Over 20 specimens were found in this transect at AU17608 in a depth of 3 m below low tide. These are presumed to have been carried in by strong tidal currents from the rocky shoreline on the west side of the estuary's mouth.

Over 50 of the microscopic gastropod *Pisinna* were identified to genus by the protoconch, which is stippled in spiral series (Powell, 1979, p. 100). Some of the mature specimens were positively identified as the common *P. zosterophila,* which lives under rocks at and below low tide to about 15 m (Morley and Hayward, 1999). They may also have been swept in by strong incoming tidal currents.

The uncommon microgastropod *Anabathron rugulosus* must also have washed from rocks at the entrance as its habitat is low tide to depths of 10 m (Powell, 1979). Four specimens of the gastropod *Nilsia cuvieranus* were found at 3 m depth. This species has been recorded by Powell (1979) from shallow water down to 70 m.

Bivalves

Two double valved specimens of *Lasaea parengaensis* (Fig. 4) were found at a depth of 3 m. This small but distinctive bivalve has previously been recorded from the Parengarenga Harbour (Powell, 1979) and Mill Bay, Manukau Harbour (Hayward and Morley, 2004). This is believed to be the first record from the Coromandel Peninsula. The small bivalve *Arthritica crassiformis* lives commensally with the rock borer *Barnea similis*, so its presence indicates that a population is living nearby.

Specimens of *Paphies australis* and *P. subtriangulata* smaller than 2 mm are indistinguishable, but larger double-valved specimens confirm that both species were present alive.

Conclusions

This study indicates that current transport tends to blur the elevational zonation patterns of molluscs more than ostracods on the edge of this tidal channel. Despite this the tidal ranges of *Zeacumantus*, and the small bivalves *Arthritica bifurca* and *Nucula* have some potential to assist in inferring past environments of fossil assemblages. In the ostracods, at least four of the more common species (*Callistocythere neoplana*, *Cythromorpha* sp. 1, *Microcytherura ?hornibrooki*, *M.* sp. 1) appear to be largely confined to the intertidal zone and have potential for distinguishing former tidal elevations.

Acknowledgements

We thank Jane Guise, Geology Dept, University of Canterbury, for helpful comments on ostracod taxonomy, and Ashwaq Sabaa and Hugh Grenfell, Geomarine Research, for scanning in the original drawings and field assistance, respectively.

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Appendix 1. Mollusc census data from the Whangapoua Estuary transect.
Counts = the number of specimens in each 20 cc sample. In bivalves double and single valves counted separately.

Station	1		2		3		4		5		6		7		8		9	
AU No.	17600		17601		17602		17603		17604		17605		17606		17607		17609	
Metres above/below low tide	1.1		0.9		0.7		0.5		0.3		0.1		-0.1		-1.5		-3.0	
Station	**1**	**1**	**2**	**2**	**3**	**3**	**4**	**4**	**5**	**5**	**6**	**6**	**7**	**7**	**8**	**8**	**9**	**9**
d=double. v=single valve	d	v	d	v	d	v	d	v	d	v	d	v	d	v	d	v	d	v
<u>Gastropods</u>																		
Amalda australis	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Anabathron rugulosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Antisolarium egenum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Caecum digitulum	-	-	-	-	-	-	-	-	-	-	-	-	3	-	5	-	5	-
Chemnitzia sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Clio sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Cominella quoyana?	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Eatoniella albocolumella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Eatoniella sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Lodderia iota	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	27	-
Merelina lyalliana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Nilsia cuvieriana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
Pisinna zosterophila	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	10	50	-
Pisinna sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	17	-
Proxiuber sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Stephanopoma roseus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
Turbo smaragdus	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turritellidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Zeacumantus lutulentus	1	-	-	9	2	-	-	7	6	-	-	-	-	-	-	5	2	-
Zeacumantus subcarinatus	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Zeacumantus sp.	-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	2	-
indet. gastropod	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-
<u>Bivalves</u>																		
Arthritica crassiformis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Arthritica bifurca	-	-	-	-	1	-	-	-	3	-	2	-	4	2	11	-	5	3
Austrovenus stutchburyi	-	-	1	1	1	-	3	3	-	-	-	-	-	-	6	-	-	1
Cyclomactra ovata	-	-	-	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
Dosinia greyi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	1
Dosinia sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-
Lasaea hinemoa	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lasaea parengaensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Macomona liliana	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Melliteryx parva	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Mylitella vivens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Nucula hartvigiana	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	1
Nucula nitidula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Nucula sp.	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Paphies australis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Paphies subtriangulata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	5	3
Ruditapes largillierti	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-
Tawera spissa	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	1	-
indet. bivalve	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-

Appendix 2. Ostracod census data from the Whangapoua Estuary transect.

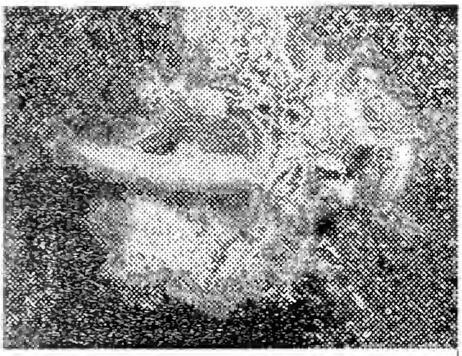
Counts = number of valves in each 20 cc sample, double and single valves counted separately.

Station	1		2		3		4		5		6		7		8		9	
AU No.	17600		17601		17602		17603		17604		17605		17606		17607		17609	
Metres above/below low tide	1.1		0.9		0.7		0.5		0.3		0.1		-0.1		-1.5		-3.0	
Station	**1**	**1**	**2**	**2**	**3**	**3**	**4**	**4**	**5**	**5**	**6**	**6**	**7**	**7**	**8**	**8**	**9**	**9**
d=double, v=single valve	d	v	d	v	d	v	d	v	d	v	d	v	d	v	d	v	d	v
Arcuacythereis sp.	-	-	-	-	1	-	-	4	2	-	3	1	-	-	4	-	-	-
Callistocythere aff. *ventroalata*	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Callistocythere dorsotuberculata	-	-	1	-	4	-	16	-	2	-	6	3	4	-	20	-	10	-
Callistocythere cf. *dorsotuberculata*	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Callistocythere neoplana	3	-	3	1	-	-	4	-	4	-	8	-	16	-	12	-	2	-
Callistocythere sp. 3	-	-	-	-	-	-	-	-	4	-	1	-	-	-	-	-	-	-
Copytus novaezelandiae	1	-	1	3	20	8	44	20	-	2	-	2	8	8	20	8	8	6
Cytherella sp. 2	-	-	-	-	-	1	-	-	-	-	3	-	-	-	8	-	8	-
Cytherella bermaguiensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Tasmanicypris sp.	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Cytheromorpha sp. 1	7	1	13	-	30	5	44	-	4	-	7	-	12	-	-	-	-	-
Cytheropteron improbum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-
Cytheropteron aff. *latiscalpum*	-	-	-	-	-	-	-	-	-	-	2	-	4	-	-	-	6	-
Eucythere aff. *mytila*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
Hemicytherura delicatula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	8	-
Hemicytherura pentagona	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
Hemicytherura quadrazea	-	-	-	-	-	-	4	-	-	-	1	-	-	-	-	-	-	-
Hermites sp. 2	-	-	-	-	-	-	-	-	2	-	-	-	4	-	-	-	-	-
Loxoconcha sp.	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Loxoconcha punctata	-	-	-	-	-	-	-	-	-	-	2	1	4	-	-	-	2	-
Maddocksella tumefacta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	4	8	4
Mckenzieartia aff. *porcelanica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Mckenziartia portjacksonensis	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	2	-
Microcytherura crassa	6	1	7	-	26	7	84	28	82	20	55	35	152	48	72	20	44	24
Microcytherura ?hornibrooki	9	-	47	1	141	-	488	40	64	-	53	-	60	-	8	-	8	-
Microcytherura sp.1	-	1	-	1	3	5	-	-	-	-	1	1	-	-	-	-	-	-
Munseyella tumidum	-	-	2	3	8	2	72	12	90	4	66	1	80	8	160	12	54	4
Neocythereis anneclarkae	-	-	-	-	1	-	-	-	8	-	3	-	4	-	4	-	-	-
Procythereis aff. *lyttletonensis*	1	-	161	-	154	8	152	4	82	-	97	12	288	8	28	4	28	-
Quadracythere cf. *biruga*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-
Swansonella novaezelandica	4	-	12	3	12	2	12	12	28	4	16	16	96	24	44	12	20	-
Swansonites aff. *aqua*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
Trachyleberis aff. *probesioides*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-
Trachyleberis sp. 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Xestoleberis sp.	7	1	-	-	-	-	-	-	-	-	-	-	8	4	-	-	2	-
Waiparacythereis joannae	-	-	5	2	13	-	180	24	44	18	30	4	32	-	232	12	144	6
Myodocopid indet.	-	-	-	-	1	-	-	-	-	-	-	-	-	-	4	-	-	-
Ostracod indet.	-	-	-	-	-	-	-	4	-	-	-	1	4	-	-	8	-	-
Total specimens	38	4	252	14	416	40	1100	148	418	48	356	77	776	100	632	88	388	48
Total species	8	4	10	7	14	10	11	9	14	5	19	11	16	6	16	10	21	6

The Original Shell Collector - The Carrier Shell

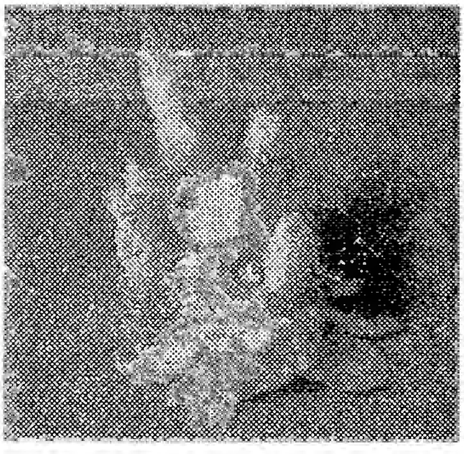
By Jenny and Tony Enderby

***Xenophora neozelanica neozelanica* Suter, 1908**
***Xenophora neozelanica kermadecensis* Ponder, 1983**

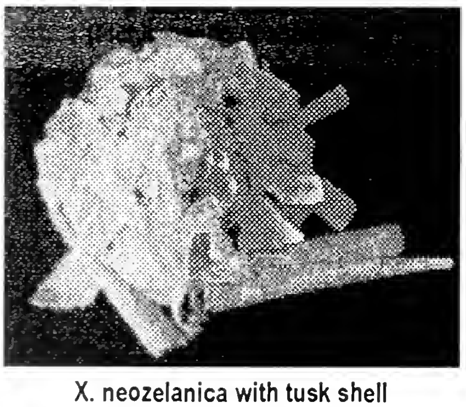


Live X. neozelanica with foot extended. (Picture taken in aquarium.)

Live X. neozelanica showing eyes and proboscis of animal. (Picture taken in aquarium.)



Live X. neozelanica covered in sponges. (Picture taken in aquarium.)



X. neozelanica with tusk shell ornamentation, trawled from outer Hauraki Gulf 200m depth.

Most of us have collected sea shells washed up after a storm. Shell collecting is not new, as many early civilisations collected them for use as money or ornaments.

The original shell collector is also a mollusc, the carrier shell, from the family *Xenophoridae*. The name is from the Greek words “xeno” meaning foreign and “phoros” meaning carrier, an apt description of a shell that carries foreign objects.

They have been around for millions of years, dating back to the Upper Cretaceous period around 95 million years ago.

Carriers are unique in that they attach other shells, usually bivalves, to their shell’s outer rim. The use goes beyond ornamentation, the empty shells are placed there as camouflage from predators. The bivalves are almost always placed concave side upwards, making it clear to predatory fish that the shell is empty. The shape of bivalves curved upwards at the outer edge makes movement of the carrier shells easier.

There are 25 known species and subspecies in three genus, *Xenophora* with 15, *Stellaria* with 6 and *Onustus* with 4 (Kreipl and Alf 1999). They are found in temperate to tropical seas and from the intertidal to off the continental shelf.

New Zealand has one representative of this world-wide family, *Xenophora neozelanica neozelanica*, and one subspecies *X. neozelanica kermadecensis*.

The New Zealand carrier shell, *X. n. neozelanica,* is found around the coast of northern New Zealand on sand and mud between 20 metres and 300 metres depth. On the east coast it extends as far as the Bay of Plenty and on the west coast to Kapiti Island. Because of its camouflage it is rarely seen by scuba divers and only comes up in trawl nets or dredges.

The smaller *X. n. kermadecensis* is found north of New Zealand around the Kermadec Islands between 85 and 275 metres depth.

The main differences between *X. n. neozelanica* and *X. n. kermadecensis* are in the smaller size of the latter and a higher spire angle (80-95deg as opposed to 60 to 85deg). The average diameter of *X. n. neozelanica* excluding attachments is listed by Kreipl and Alf 1999 as 60mm and the largest known as 84mm. In *X. n. kermadecensis* the average diameter is 50mm and the largest known is 60mm diameter. The size difference may be attributable to the much larger number of specimens known of *X. n. neozelanica*. Those in our collection and others studied, fit within this size range.

A series of shells trawled to the northwest of Ninety Mile Beach were noticeably smaller than those found on the east coast. All were in the range of 44 mm to 52 mm diameter. Several had the sculpture on the base typical of *X. n. kermadecensis*.

We studied and photographed several live specimens in an aquarium over a period of several months. They were notice-

ably more active at night. Our attempts to photograph specimens in the sea were unsuccessful with the animals not emerging from the shells.

The foot of the animal, which other gastropod molluscs use for crawling like a garden snail, has adapted into a two-part appendage. This enables it to collect and hold shells and other objects against the outer rim of its own shell. An adhesive, which the animal secretes, hardens and the shell becomes a permanent fixture. As well as bivalves, gastropods, brachiopods, tusk shells, corals and stones are used, depending on the sea floor where the animal lives. Some specimens from around White Island have attached pieces of volcanic glass or obsidian.

In the days before pressure on the Hauraki Gulf from silt runoff, chemicals and bottom trawling, large numbers of carrier shells lived there. Some of these, seen in old sea shell collections, had attachments of tusk shells, lesser known members of the mollusc family.

Another unusual attachment variant are brachiopods or lamp shell, which are common in the Hauraki Gulf. Brachiopod fossils date back some 500 million years.

Some carrier shells carry live brachiopods which may have attached to the carrier shell when floating as larvae. Solitary corals lalso attach as larvae.

Little is known about the method of selection the carrier shell makes for its attachments. We do know that the process of attachment is a long and difficult one for the animal and that it has adapted perfectly for the job.

The foot of the carrier shell animal is long and muscular and rather than crawling across the sand in the conventional snail manner the animal hops along. This method of movement is also common in the family *Strombidae*. The foot extends into the sand and in one muscular movement it jerks the shell towards with its foot. This is repeated and the carrier shell can move quite quickly, leaveing a trail of indentations in the sand as it moves.

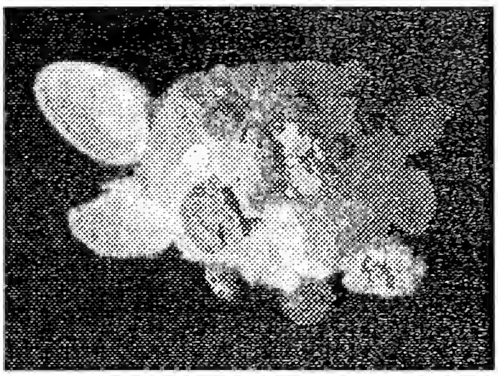
The carrier shells we studied in an aquarium situation seemed to feed by grazing on the algae growth on rocks and dead shells in the tank.

Carrier shells cast up rarely on beaches are usually badly battered and ignored by most beach wanderers. In many years of beachcombing after storms we have only found three. The exception was the Mission Bay beach reclamation. Sand for the beach reclamation was dredged from 40 metres depth, off Mangawhai and Pakiri Beaches (see NZ Geographic No 31, July-September, 1996) and numerous live carrier shells were found on the beach. Apart from this sort of occurrence, they are destined to remain one of New Zealand's more unusual and less studied molluscs.

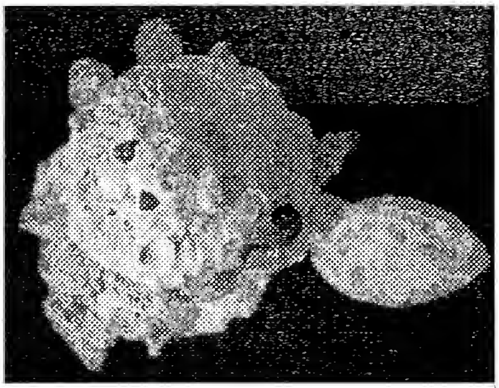
References:

Kreipl, K. and Alf, A., Recent Xenophoridae, Conch Books, 1999

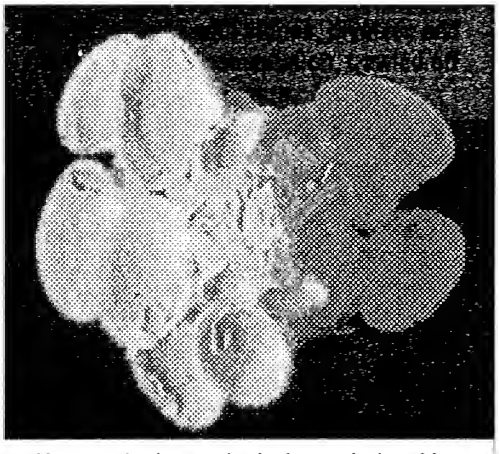
Ponder, W. F., Xenophoridae of the World, memoir 17, The Australian Museum, Sydney, 1983



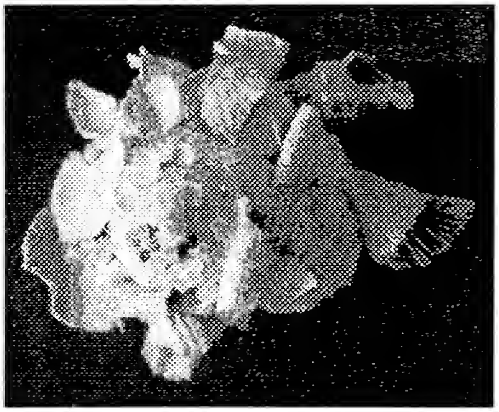
X. neozelanica with stones, bivalves and solitary coral ornamentation, trawled off Houhora.



X. neozelanica with large brachiopod, trawled near Kawau Island, Hauraki Gulf.



X. neozelanica typical of population 30m near Pandora Bank, off 90 Mile Beach.



X. neozelanica with bivalves, tusk shells and solitary coral from200m, outer Hauraki Gulf.

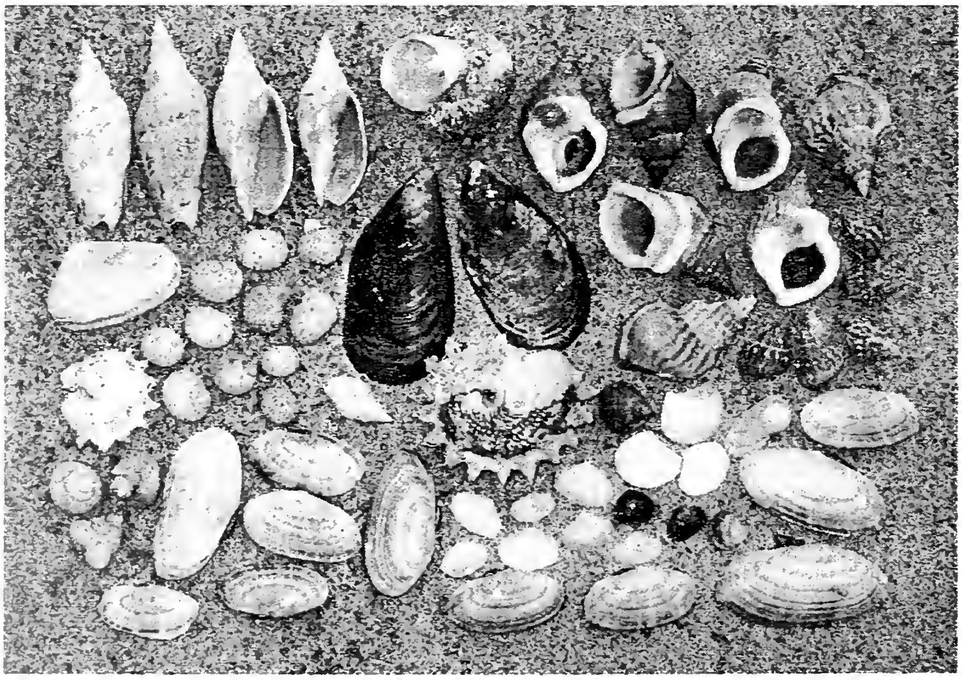
MAORI BEACH, STEWART ISLAND
by Bev Elliott

Nearly 35 years ago, in March 1970, I stood on the beach at Lee Bay, Stewart Island and looked towards distant Mount Anglem at 3214 feet, the highest peak on the island. "Some day I'm coming back to climb you," I said. But somehow it never happened, and Mt Anglem remained a faraway dream. When at last I stood again on the beach at Lee Bay, on Oct. 18th 2004, looking towards Mt Anglem, I knew it always would be a faraway dream. Old age had caught up with me, and a tramp of that distance and difficulty, was out of the question. However, I was still fit enough to go some of the way, and I was a good deal more venturesome than I was back in 1970. I shouldered my pack, and set off into new territory.

By the time I reached Maori Beach, I was very glad to put that pack down. I pitched my tent and set off along the beach without the heavy weight. It was a delightful place, a kilometre of white sand with gentle waves, blue water and shells! I hadn't even been thinking about shells. I was there for the scenery, photos and bird listing for the Ornithological Society. Suddenly it looked as though a species list of shells would be worthwhile.

First to attract my attention were the huge Gari lineolata, up to 90mm, with attractive rayed patterns. There were plenty of Struthiolaria papulosa and nice Alcithoe swainsoni. I had to be very selective as they would have to be carried a considerable distance and my pack was heavy enough! Thracia vitrea were more the weight I was prepared to carry, numerous halves and 4 complete; also Sclapomactra scalpellum. Large Tanea zelandica were common, some carrying Alcithoe eggs. There was a good large Turbo granosa. I was able to find about 50 species and added several more by getting down on hands and knees and peering closely at a line of fine beach drift – aided by numerous sandflies! The tide was high and I didn't have a chance to check the rocks at low tide.

I walked to Port William the next day, a bare sandy beach apart from one nice Astraea helotropium and then on to Sawyers Beach, where the scenery was beautiful, but the shelling was poor. And there was Mt Anglem looking so much closer, although I'd only covered a quarter of the distance. I took a couple of photos of it and that's the closest I'll ever get to it. Then back to Maori Beach for a second night and several more walks along the beach, for a total of over 70 species of shells.



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CONTENTS

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Molluscs in shelf and bathyal cores from Wanganui Bight and the East Coast of the North Island

By Margaret S. Morley and Bruce W. Hayward

Summary

Fifty-one molluscs (25 gastropods, 24 bivalves and 2 scaphopods), one echinoderm and one coral are listed from core samples taken by the French research vessel Marion Dufresne from Wanganui Bight and off the east coast of the North Island during January and February 2006.

Introduction

In January-February 2006, BWH was on board the French research vessel Marion Dufresne which was taking long cores of seafloor sediment around New Zealand (Fig. 1) for a variety of paleoclimate and sedimentary history purposes. Molluscs were absent or uncommon in most of the 32 cores that were taken. One core (MD06-2992) recovered a rich fauna of larger molluscs and bryozoa and these were separately collected and identified. All other mollusc faunas reported here came from samples that were taken for foraminiferal studies. When the mud was washed away from these samples, small or broken shells were found on the 150 µm sieve. Thus the molluscs recorded are not an exhaustive list of species that might be present, but just a small sampling. Larger samples (c. 50 cc) were available from core catchers and these usually had more molluscs than the smaller samples (20 cc) from within the cores themselves.

The core catcher is an apparatus with upward pointing teeth that is screwed on the base of the core barrel and prevents the sediment core from falling out of the barrel as it is pulled out of the sediment and hauled back up to the ship. About 10 cm length of the deepest cored sediment from the bottom of the core is trapped in the core catcher when it is removed from the core. As this sediment cannot be recovered without disturbing its sequence, it is often of little value for detailed studies and therefore larger samples of this disrupted sediment is available for studies (like ours) that do not require the sequence to be retained.

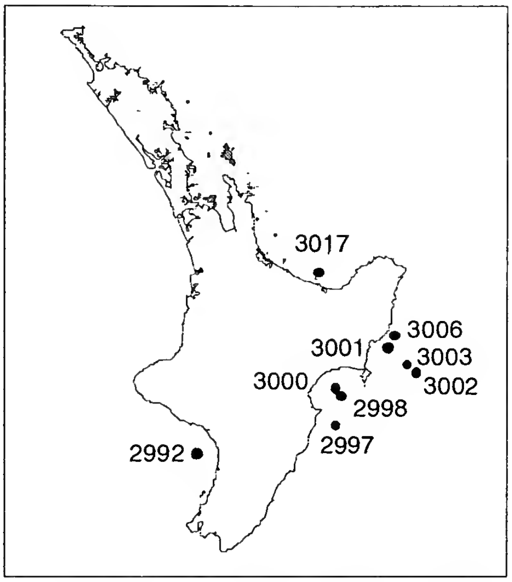

Fig. 1. Location of Marion Dufresne core sites. All site numbers are prefixed by MD06-.

Some mollusc identifications are tentative because specimens are juveniles, damaged or only pieces. Many species are represented by only one specimen (see · species list). Voucher specimens are in MSM's collection.

Each core is allocated a unique hyphenated number. The first part (MD06) refers to the ship Marion Dufresne and the year (2006). The second four numeral part is sequentially the number of cores taken from the ship since it was launched.

Because of the high sediment supply to the East Coast, all the samples from this area and the one from the Bay of Plenty are likely to be of Holocene or latest Pleistocene age (probably all younger than 20,000 years old). The one sample from Wanganui Bight did not penetrate the seafloor, where it was hoped to retrieve Pleistocene sediment. Detailed study of interbedded ash beds which is planned by other participants will undoubtedly help provide more accurate ages for these samples.

MD06-2992 and 3003 in water depths of 60 m and 1389 m respectively have the greatest diversity and abundance of molluscs.

Faunas from individual cores (Fig. 2, species list)

Wanganui Bight
MD06-2992, core catcher sample from seafloor.
40° 16.30'S 175° 04.74'E, 60 m water depth.

22 species are recorded from this sample. All except two species present are still living today. The fragile specimen of the muricid *Xymene bonneti* is a Castlecliffian fossil, 1.6-0.34 million years old (Beu and Maxwell 1990 p 359), it has damage to the spire and outer lip of the aperture. The presence of a live specimen of *Corbula* indicates that the fauna is a mix of modern and fossil Pleistocene (Castlecliffian) molluscs. Seismic profiles indicate that Pleistocene strata directly underlie the site and they are probably the source of the reworked fossils.

Powell identified the tusk shell *Siphonodentalium delicatulus* by the distinctive six slits at the apex (1979, p.354 named *Cadulus* delicatulus). The 3 mm juvenile tusk shell in this sample differs from Powell's description having eight narrow longitudinal ribs which terminate in sharp spines at the apex creating eight slits (Fig. 2).

Hawkes Bay
MD06-2997, core catcher sample from 3 m below sea floor.
39° 52.07'S 177° 22.91'E, 385 m water depth.

MD06-2998, core catcher sample from 30.3 m below sea floor.
39° 25.16'S 175° 28.16'E, 89 m water depth.

MD06-3000, sample from 56-60 cm below seafloor.
39° 21.83'S, 177° 24.88'E, 70 m water depth.

The sculpture on fragments of a pectinind valve allowed a tentative identification of *Veprichlamys kiwaensis.*

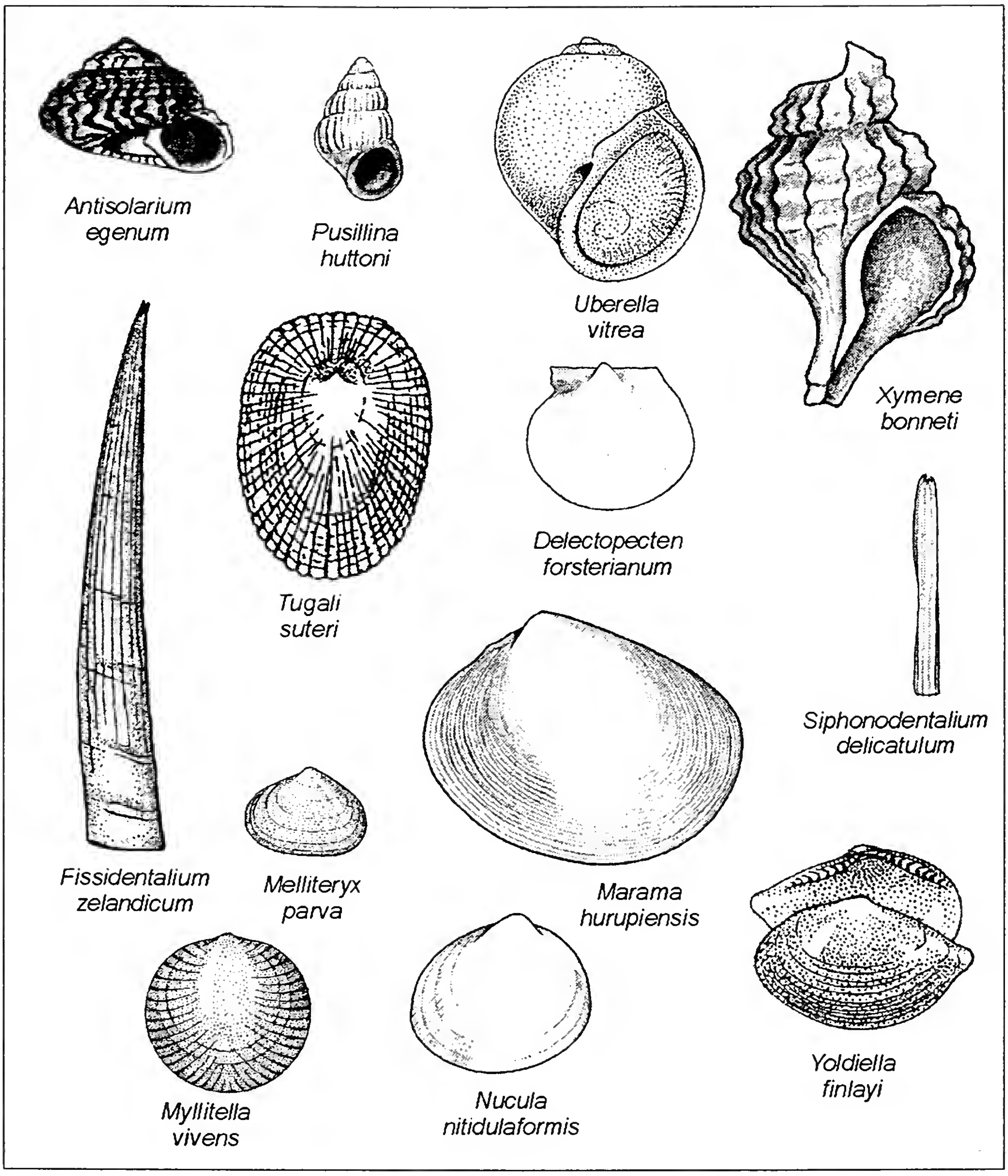

Fig. 2. Some of the molluscs in the Marion Dufresne cores. Drawings by Powell (1979) and Margaret Morley.

Poverty Bay

MD06-3001, core catcher sample from 22.5 m below sea floor.
38° 44.31'S, 178 13.08'E, 59 m water depth.

MD06-3002, sample from 20 m below sea floor.
39° 07.83'S 178° 40.31'E, 2293 m water depth.

MD06-3003, sample from 12.88 m below sea floor.
39° 02.79'S, 178° 32.17'E, 1398 m water depth.

The gastropods (Fig. 2) included a turrid *Austrodrillia sola,* but unfortunately the missing body whorl precluded firm identification, this species has been previously recorded off the Three Kings Islands in 180 m (Powell 1979). Also present were the siphon whelk *Penion* sp., turret shell *Zeacolpus pagoda,* microscopic shells *Odostomia incidata, Zeradina* cf. *producta* and a planktonic mollusc, *Clio pyramidata ?*. A deep water species *Bonellitia superstes* was damaged.

Bivalves included *Leionucula strangei*?, pieces of ?*Euciroa galatheae, Neilo australis, Nucula* sp. and *Tawera* sp. A juvenile valve of *Marama hurupiensis* is a Tongaporutuan fossil aged 10-7 million years (Beu and Maxwell 1990).

MD06-3006, core catcher sample from 25.4 m below sea floor.
38° 57.60'S 178°10.92'E, 122 m water depth.

This sample contained the gastropods: knobbed whelk *Austrofusus glans,* wentletrap *Boreoscala zelebori* and pyramidellid *Chemnitzia* sp.

Two tusk shells (scaphopods) were present, *Siphonodentalium delicatulum ?,* previously *Cadulus delicatula* and *Fissidentalium zelandicum.*

The bivalves tentatively identified from pieces or juveniles included *Scintillona zelandica, Elliptotellina urinatoria* and a 2 mm specimen of *Dosinia lambata.* One specimen of *Hiatella arctica* was also present. This species is recorded to depths of 180 m (Powell 1979) and commonly live in depths of 6-10 m in the Bay of Islands (Morley and Hayward 1999).

Pieces of test and one spine of an echinoderm were found.

Bay of Plenty

MD06-3017, core catcher sample from 106 m below sea floor.
37° 44.77'S 176° 59.77'E, 106 m water depth.

A microscopic gastropod *Zeradina* sp.was found in this sample together with small bivalves *Melliteryx parva, Myllitella vivens* and *Scintillona* sp.

Species list

Marion Dufresne cores Jan-Feb 2006 (prefixed by MD06-)
KEY p=piece, 1=numbers of specimens

	2992	2997	2998	3000	3001	3002	3003	3006	3017
Gastropoda									
Agatha georgiana						1			
Amalda sp.							p		
Antisolarium egenum							1		
Austrodrillia sola?							1		
Austrofusus glans	1				1			1	
Bonellitia superstes							1		
Boreoscala zelebori								p	
Chemnitzia sp.								p	
Clio pyramidata?							1		
Maoricolpus roseus	4								
Maoricrypta costata	1								
Maoricrypta monoxlya	1								
Odostomia incidata							1		
Penion cuvieranus?	1								
Penion sp.							p		

	2992	2997	2998	3000	3001	3002	3003	3006	3017
Pusillina huttoni							1		
Tugali suteri	1								
Uberella vitrea	1					1			
Xymene bonneti	1								
Zeacolpus ascensus?						1			
Zeacolpus pagoda	2					1	1		
Zeradina cf. *producta*							1		
Zeradina sp.									p
Scaphopoda									
Siphonodentalium delicatulum?	1		1				1	1	
Fissidentalium zelandicum	2						p	p	
Bivalvia									
Barbatia novaezelandiae	2								
Cardita aoteana	3								
Corbula zelandica	6								
Delectopecten fosterianum		p							
Dosina zelandica	3								
Dosinia lambata?								p	
Elliptotellina? urinatoria								p	
Euciroa galatheae?							p		
Hiatella arctica								1	
Leionucula strangei							1		
Mactra discors	1								
Maorimactra ordinaria	6								
Marama hurupiensis	1						1		
Melliteryx parva					1				1
Mesopecten convexum	1								
Myllitella vivens									1
Neilo australis							p		
Nucula nitidulaformis							1		
Nucula sp.							p		
Ostrea chilensis	2								
Pecten novaezelandiae	5								
Scintillona zelandica								p	p
Talochlamys zelandiae	17								
Tawera sp.							p		
venerid				p					
Venericardia purpurata	11						1		
Veprichlamys kiwaensis?				p					
Yoldiella finlayi							1		
Echinoderm									
indet.								p	
Coral									
Monomyces rubrum	1								

Acknowledgements

Many thanks to Ashwaq Sabaa who scanned the drawings.

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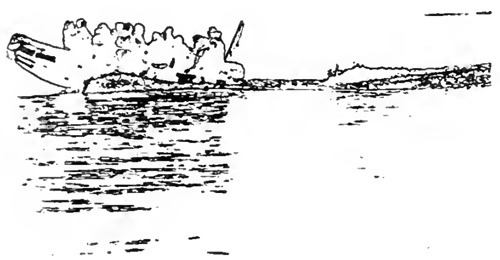
AN ANTARCTIC PECTEN - ITS POLYMERS AND USE AS A BIO-MONITOR IN ASSOCIATION WITH OTHERS

MICHAEL K. EAGLE

Mention the common name scallop and it immediately conjures up a vision of succulent. tasty, crumbed morsel melting in butter and diced parsley. Scallops are often simply referred to as "pectens", belonging in the superfamily Pectinoidea, family Pectinidae, which has a number of genera and several hundred species occupying both sub-tidal to bathyal ecological niches. A diversity of patterns and colours means that specimens are appealing to collectors. Scallops are classified as bivalves; two half-shells (or 'valves') attached to each other by a strong hinge. The adductor muscle (large and tasty) is attached to the centre of each valve so that when it contracts valves close, protecting the animal's viscera. The adductor muscle exerts force only to close the shell, not to open it. For that to happen, a little pad of protein (a natural elastic made of abductin) located just inside the hinge is squashed when the shell closes, but as the adductor muscle relaxes, the pad rebounds and pushes the valve back open. Scallops are opportune filter-feeders on soft substrates.

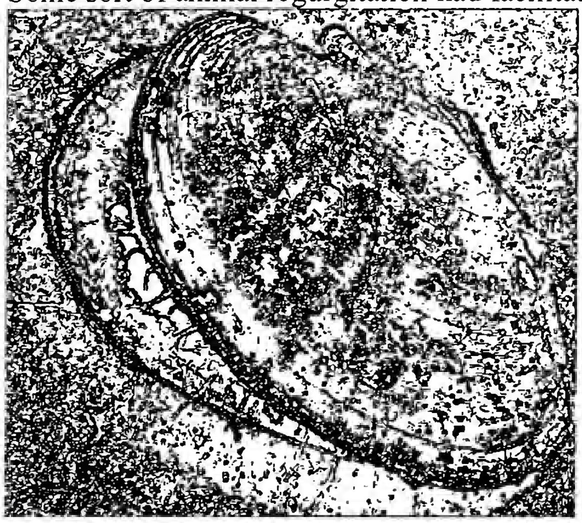
When I was in America recently, I was careful to purchase only closed valves of the giant Pacific Scallop ***Patinopecten caurinus*** Gould 1850, knowing that they were very much alive and well in tightly shut shells. Other molluscs such as squid and octopus are well known for their jet-propelled locomotion, shooting smoothly along in the water column. Pectinids are also able to swim. Some species are sufficiently limber enough to wobble unsteadily through the water by 'flapping' their valves, usually as a lift-off escape mechanism from their main predator, sea-stars. The jetting mechanism works when the adductor muscle closes the shell, squirting water out; when the adductor muscle relaxes the shell is popped back open by the spongy pad allowing water back inside to replenish supply, awaiting the next 'jet'. The cycle is repetitive until safety or a better food supply is achieved. An array of weak, minute eyes peeking out of the tentacle mantle enables sensory perception. A weak byssal notch exists on the anterior of the right valve. Shells are characteristically 'fan-shaped' with variation in surface sculpturing and the size or shape of the hinge-like 'ears' either side of the umbones (beak).



The endemic New Zealand Scallop, ***Pecten novaezelandiae*** Reeve, 1853 is well known in this way, but also as a humble ashtray, jelly moulds for children's parties, paper clip tray, and the archetypical spade for making sand-castles at the beach. Even the British and Mediterranean Great Scallop, ***Pecten maximis*** (Linnae, 1758) is re-known as an emblem hand-sewn to the cloaks of Christian knights, then symbolic of participating in the Middle East Crusades. It is also well-known today as the logo of multinational Shell Petroleum. Most common scallops are found in tropical to temperate seas and are

generally easy to obtain either by amateur or commercial fishing. Those occurring in deep water are not so common and much more difficult to obtain as are the very few species that today live in Polar waters.

During four trips to the Antarctic at the end of last year and the beginning of this year, I was fortunate to acquaint myself up close with the locally common Antarctic species Colbeck's Scallop, ***Adamussium colbecki*** (E. A. Smith, 1902). I had previously been given some disarticulated valves of the mollusc by Dan Hikuroa, University of Auckland on his return from a trip to the British Antarctic Survey base, Rothera, Antarctic Peninsula. I was delighted to receive them. On my trips, I occasionally I had the use of a Zodiac inflatable and spent time slipping in and out of icebergs, as well as sampling local marine faunas. Appropriate permits allowed for the collection of voucher specimens including limpets such as ***Nacella concinna*** (Strebel, 1908) and small bivalves. It was on one such trip in the vicinity of the Yalour Islands, Antarctic Peninsula that quite remarkably, I came upon a closed, beach-drift specimen of ***A. colbecki***, occasionally seen washed up, predated or scavenged and disarticulated, but rarely alive. Some sort of animal regurgitation had facilitated the occurrence as dried mucus and



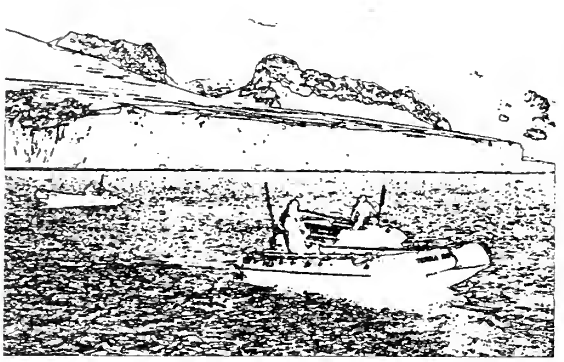
voided food including crustaceans, surrounded the specimen lodged amongst volcanic cobbles. Although used to a different pressure regime, temperature, and salinity, the specimen somewhat revived in a bucket of cold seawater, and later, when gently prodded, swam. I eventually released it into the sea.

A. colbecki is found throughout Antarctica and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, and South Sandwich Islands at depths from 0 to 1,500 meters. It is a free-living scallop and has a thin, fragile, sometimes flexible shell with 15 to 22 radial ribs, fine concentric striations, and small ears. Shell pigmentation of ***A. colbecki*** is plum to reddish-purple to brown and a maximum shell length of twelve centimeters has been recorded. Although it is characterized by a patchy distribution, ***A. colbecki*** is considered the most important bivalve of Antarctica, particularly in relation to its functional role in the transfer of energy from the water column to the benthos.

The jet-power phase of ***A. colbecki*** is limited to a short part of the valve 'clapping' cycle. ***Adamussium colbecki*** makes the most of what power and thrust it can produce. Swimming duration may be longer than ten seconds, covering up to 45 centimeters, with level swimming speeds measured by some studies at between 12 and 23.5 centimeters per second. ***Adamussium colbecki*** lightens the swimming load by having thin shells, a weakness offset by minute corrugations. As inefficient as jetting is for all scallops, ***A. colbecki*** faces even tougher challengers. Adductor muscle output decreases in the cold and cold water is more viscous, providing additional resistance and drag when swimming. ***Adamussium colbecki*** is barely able to sustain level motion as it also has to contend with temperatures of minus degrees Celsius temperatures which

should make the spongy abductin pad less elastic, less able to store energy, and harder to push a valve open. In ***A. colbecki*** the shell contributes less to the animal's total weight than it does to temperate or tropical scallop species, providing the adductor muscle less shell to close with each jet cycle. Recent research has ascertained that ***A. colbecki*** has a closing adductor muscle half the size as that of a warm-water bivalve of similar size, reducing weight to carry around. However, the combination of reduced shell mass and adductor muscle translates into a severe handicap for the scallop, equating to a ratio of jetting power to animal mass only 20 percent of a comparative warm-water scallop. The situation suggests that shutting the shell takes less energy but incurs more time to do so, the reason why ***A. colbecki*** can barely 'jet'. To make up for the reduction in adductor muscle size the Antarctic scallop's abductin possesses a better response to temperature than that of temperate-zone molluscs. The difference in performance is small; the energy returned by the Antarctic abductin is a minor component of that needed to 'jet'. A polymer pad that retains bounce in intense cold, however, would be useful in the space-programme or deep-sea submersibles and further research to synthesize this continues.

Epibionts of ***A. colbecki*** confirm the importance of the mollusc's shell as an eco-engineer and as a natural secondary substrate for many taxa. Due to its ability to swim, the scallop may contribute to the dispersal of many epibiotic and symbiotic species, thence increasing their survival prospects in an oligotrophic (food scarce) and seasonally hostile environment. Calcareous foraminifera ***Cibicides refulgens*** colonises the shell of ***A. colbecki*** and grazes algae and bacteria living on the surface as well as suspension feeding through a pseudopodial net deployed from a superstructure of agglutinated tubes extending from the foram's calcareous test. The foraminifera also parasitizes ***A. colbecki*** by chemically dissolving a small area of the scallop shell to free-feed on amino acids produced in the scallop's extrapallial cavity. ***Adamussium colbecki*** may have the bush sponge ***Homaxinella balfourensis*** (Ridley & Dendy, 1886) attached growing up to fourteen centimeters in height (particularly if the scallop is larger than seven centimeters), near the shell's peripheral margin. Obviously the sponge seeks the water flow over the scallop shell in order to facilitate its own filter feeding. ***Adamussium colbecki*** may also be colonized on either shell by a small (two millimetres high) hydroid ***Hydractinia angusta*** Hartlaub, 1904 which eats the tube feet and pedicellariae of sea urchins (including the cidaroid ***Sterechinus neumayeri*** (Meissner, 1900)), that algal graze on the surface of the scallop's shell. ***A. colbecki*** shells are very thin and such grazing may damage the shell. ***H. angusta*** eats the bio-film (that includes agglutinated diatoms) able to be removed by its tentacles from the shell of ***A. colbecki***, as well as any sediment stirred-up by the scallop 'clapping' when swimming. *H. angusta* also reduces settlement of ***A. colbecki*** larvae onto the shells of adults, thereby successfully competing for shell space, retaining a commensual epibiotant relationship.



Adamussium colbecki spawns and fertilizes at the start of ice-melt in September. Unprotected larvae live for more than 100 days feeding on plankton. Juvenile ***A. colbecki*** (up to five centimeters in size), are often attached by byssal threads to the upper shell of adults, a survival mechanism which provides a tiered filter feeding arrangement in the water column and helps juveniles lessen their visibility as prey by giving them camoflage and which also takes advantage of the much faster, stronger swimming predator escape response of an adult. ***A. colbecki*** predators include the seastars ***Notasterias armata*** Koehler, 1911, ***Lophaster gaini*** Koehler, 1912, and ***Odontaster validus*** (Koehler 1911), the brittle star ***Ophiosparte gigas*** Koehler 1922, the proboscis worm ***Parborlasia corrugatus*** (McIntosh, 1876), the Antarctic carnivorous gastropod ***Neobuccinum eatoni*** (Smith, E.A., 1875), and the fish ***Trematomus bernacchii*** Boulenger 1902. *A. colbecki* has a swimming escape response to predators and disturbances, and has been observed swimming twenty meters above the bottom. As ***A. colbecki*** is a filter-feeder living in shallow depressions it makes on the seafloor; its food includes benthic diatoms, foraminifera, and detritus. The mollusc's digging of shallow depressions re-suspends detritus for filter feeding by ***A. colbecki*** which grows much more slowly than scallops in temperate water. Small ***A. colbecki*** specimens (less then fifty millimetres in shell length) grow at a rate of ten millimetres per year. Larger specimens grow at a rate of 0.8 millimetres per year. Growth curves produced by biological studies indicate that ***A. colbecki*** that are eight centimeters in shell length are estimated to be 14-18 years old, relatively long lived for a mollusc. A low level of fishing could effectively eradicate ***A. colbecki*** populations.

Regular and effective monitoring using appropriate sentinel organisms (bio-monitors) such as ***A. colbecki*** are used to assess the anthropogenic impact on the pristine Antarctic environment by natural and human pollution and to facilitate early detection of negative effects on the ecosystem. Mussels and oysters have previously been used worldwide as bio-monitors. These bivalve species, however, are absent in Antarctic waters. ***Adamussium colbecki*** and another bivalve, ***Laternula elliptica*** (King &. Broderip 1831) are used instead by virtue of their circum-Antarctic distribution, large body size, and high population density. These two bivalves are also among the most common macrofossils found on uplifted beaches around Antarctica. The endemic Antarctic soft-shelled member of the Laternulidae, ***L. elliptica*** is a filter-feeding bivalve, burrowing deep in the bottom sediment, thereby avoiding being crushed by ice movement. The species has a delicate, pearly (aragonitic) shell, usually fat and elongate, gaping at the posterior, with the umbones possessing an external slit, and valves of the animal lacking teeth in the hinge. ***Laternula elliptica***, is widely distributed around Antarctica and adjacent islands at depths from 1 to over 400 m, occurring frequently as dense patches (~ a few hundred inds/m^2) in shallow (20-30 m) and sheltered areas. It grows to a shell length of approximately 10 cm in 20 years or so. Studies have determined metal concentrations in various tissues of ***L. elliptica*** and ***A. colbecki***, confirm eligibility as sentinel organisms for marine pollution monitoring. A wide range of natural variability has been found in baseline metal levels of these bivalves among different body sizes, tissues and also among different geographical localities. Cadmium is naturally present to some degree in these two herbivorous bivalve species as with other Antarctic herbivorous organisms. Utilities of histological and sub-cellular level responses as bio-makers to contaminant exposure have also been suggested in ***L. elliptica*** and ***A.***

colbecki. The patellid limpet ***Nacella concinna*** (previously mentioned) has also been recognized as a useful bio-monitor. Although not as widely distributed as ***L. elliptica*** and ***A. colbecki*** in the Antarctic, ***N. concinna*** occurs in high densities about the Antarctic Peninsula, where base density and expedition traffic is higher than anywhere else in the Antarctic. Additionally, ***N. concinna*** is often the only large organism found living inter-tidally, an ecological niche most vulnerable to anthropogenic pollutants from these sources.

Cold often produces gigantism in animals. This is contrary to what has occurred in ***A. colbeki***. In order to survive Polar seas, the fragile mollusc has physically reduced size and weight to now be only half the tasty morsel provided by other temperate scallops. ***Adamussium colbecki*** is a true bio-engineer actively participating within the marine community as a vagrant, benthic water purifier, secondary substrate, host, and active swimmer able to disperse epibiotant larvae. Evolution of the species has been driven by the need to develop functional morphology able to operate within an extreme, seasonal, environment. It is a remarkable scallop, made more so by it's vast distribution around the continental shelf of the world's coldest and southernmost continent, Antarctica.

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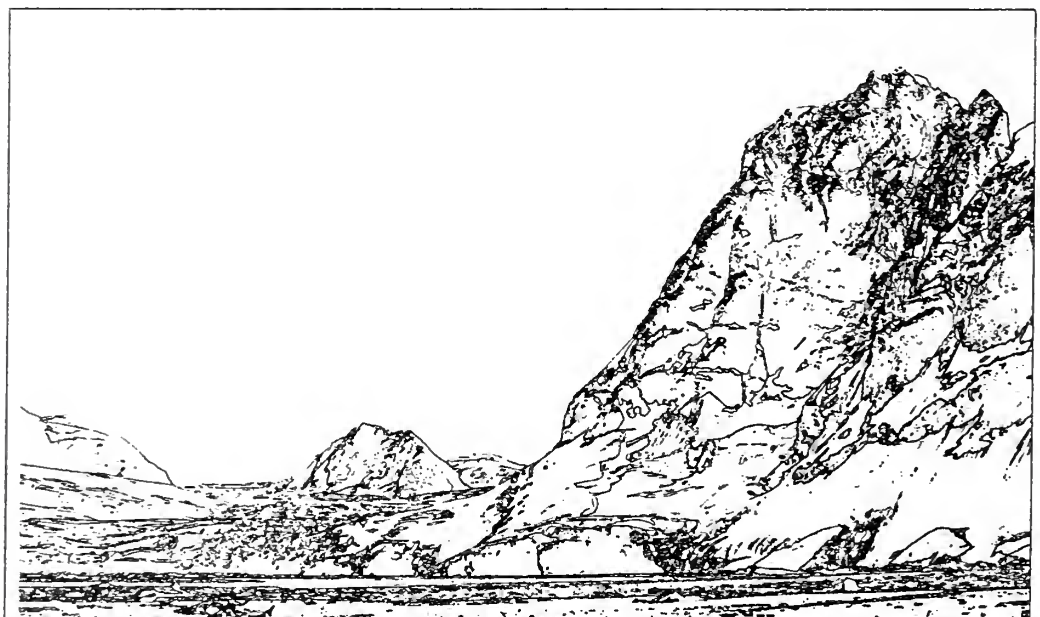

Collecting in Antarctica, South Georgia, Falklands and South America

Margaret S. Morley

Summary

A total of 35 mollusc species (2 chitons, 22 gastropods, 11 bivalves) were collected from Antarctica, South Georgia, Falklands and South America in early 2007. These comprised 10 gastropods and 4 bivalves from South America, including fresh-water species; 4 gastropods from Antarctica; one gastropod from South Georgia; and 2 chitons, 16 gastropods and 10 bivalves from the Falkland Islands (see species list).

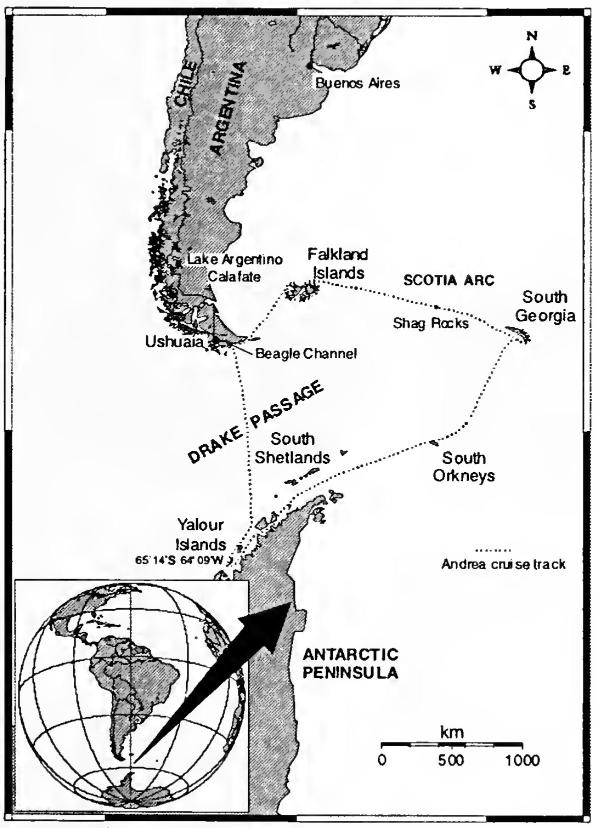

Fig. 1 Map of the locations visited.

Introduction

From January 16 to February 3 2007, Heather Smith, Alison Stanes (Heather's twin) and I made an epic voyage to Antarctica. The tourist boat *M. S. Andrea* with 80 passengers left Ushuaia in Argentina, South America for a nineteen day cruise across Drake Passage to the Antarctic Peninsula as far south as 65°14'S, 64° 09'W at the Yalour Islands. Then we sailed north again to the South Shetlands Islands, north-east to South Georgia and finally back to Ushuaia after calling at the Falkland Islands, a total voyage of 3526 km, mostly in open ocean (Fig. 1). In fact Drake Passage felt very open with 50 knot gale force winds, listing 47° to each side and being pounded by 10 m waves!

During the planning stage we decided that it would add enormous interest to the trip to be able to collect shells. To this end I sent many emails enquiring about who to contact and what permits we would need to collect for the Auckland Museum.

After many false starts I finally got a promise of an export permit from South Georgia which is administered by the United Kingdom. When *Andrea* arrived there I had an amazing form to fill in, what was I going to collect, the number of species, how many and their weight? Fortunately I had prepared a list of possible species using scientific names as requested. To add to the confusion, the officer that I had been in touch with had gone on holiday to New Zealand and had not briefed his deputy! I became very nervous about missing the last zodiac ashore while filling in time-consuming forms. I don't think the officer was any wiser when I handed it back!

The second hurdle was a permit to collect in Antarctica. Despite a year of emails and filling in yet more demanding forms, I was informed only days before we left, that they had consulted with lawyers and because I retain a United Kingdom passport I didn't need a permit after all! Although this was a great relief, I was also astounded and disappointed that one of the world's most pristine places had so little protection. This made it difficult when

passengers landed because we had been strongly told NO collecting by the tour operator, not even a stone or feather. I had permission but no permit to prove it, so I just spread the word I was collecting for the Museum.

Calafate, Argentina

After arriving in Buenos Aires, Argentina we flew south to Calafate (Fig. 1). Although a long way from the sea, Heather and I managed to do some collecting across a kilometre broad expanse of marsh and boggy swamp along the edge of Lake Argentino. A relentless, wild wind threatened to sweep us away, despite the bleak conditions our perserverance was rewarded by finds of *Chilina gibbosa* (Fig. 2), *Succinea* sp., *Potamopyrgus* sp., *Planorbis* sp. and the small bivalve *Pisidium casertanum. Succinea* is a world wide genus (Powell 1979 p. 297). In New Zealand it lives in high numbers in dry sand dunes, surprisingly in Argentina it inhabits swampy, water-logged muddy sand. The spines of the adult *Chilina gibbosa* were eroded by the acidic conditions similar to damaged spires in the New Zealand species *Melanopsis trifasciata*.

Our next flight was to Ushuaia on the Beagle Channel, promoted as the southern-most town in the world. Heather and I were irresistibly drawn to the only accessible bit of coast in town, a breakwater near the naval base. We had to clamber down unstable boulders

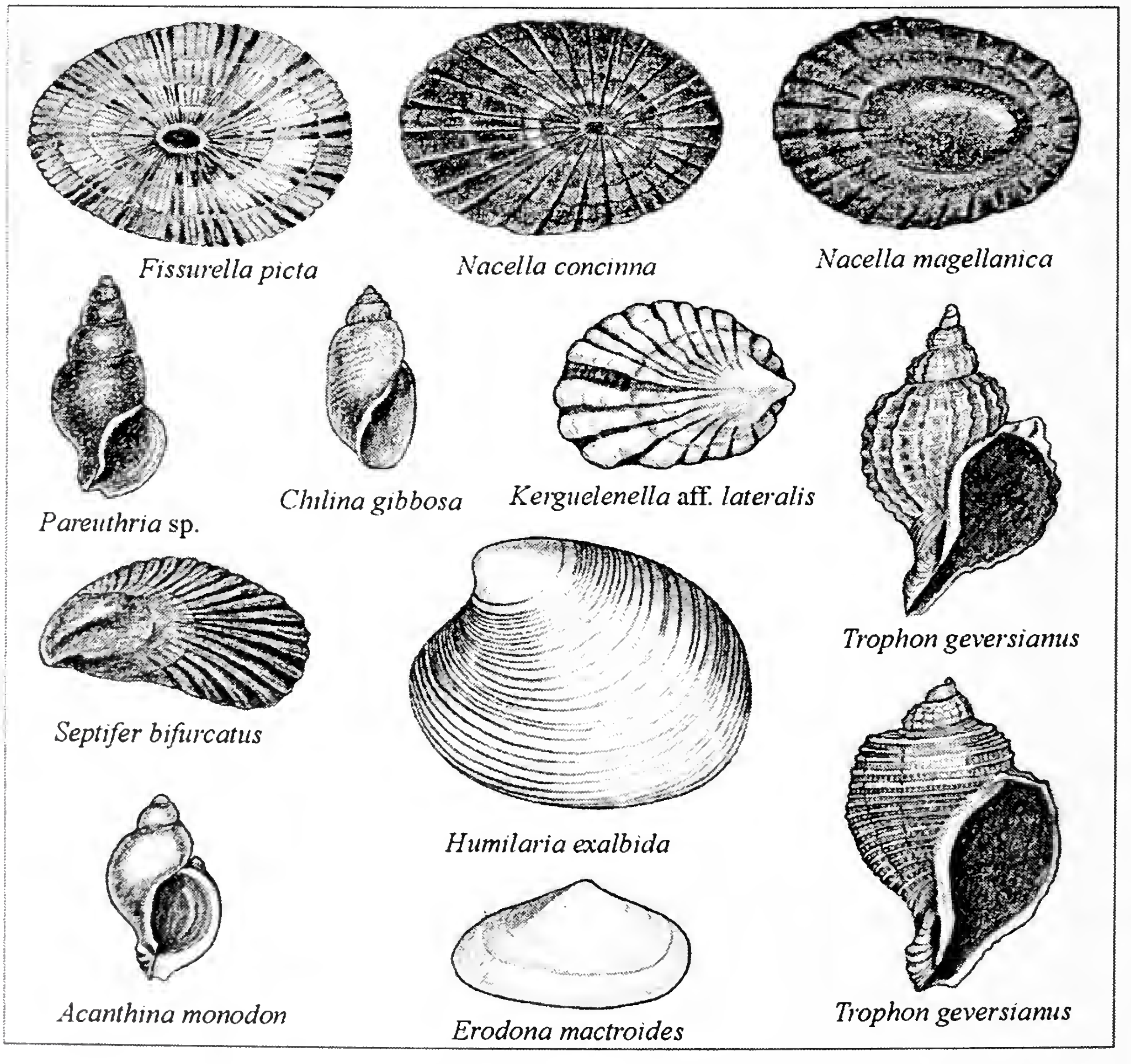

Fig. 2 Some mollusc species collected.

to get to the water and expected to be fired on or possibly arrested at any moment! Our efforts resulted in very cold hands and a few specimens of *Siphonaria* sp. and *Nacella magellanica.* I also spent a morning searching the town causeway. The overgrowth of *Ulva* seaweed, an abundance of a single species of huge isopod 20 mm long, not to mention the smell, confirmed my suspicions that the area is polluted. There was an interesting selection of shells, crabs and a sea urchin washed in (see species list). The specimens of *Trophon geversianus* showed a wide range of sculpture from spiral to clathrate, some developing frilled axials (Fig. 2). A dominant species in the wash up was the large, bronze-tinged limpet *Nacella magellanica.* Small periwinkles *Laevilitorina calginosa* were common on high tidal rocks.

Antarctica

Prior to the trip I studied the literature and even sketched possible species but intertidal species are rare. This is because the shore is only ice free for four short months of the year. Not only is there ice on the surface but also on the sea floor to a depth of 30 m, known as anchor ice (Fig. 3). The species in the Auckland Museum are all from dredgings in depths of over 30 m collected during the Discovery Expeditions in the 1930's. At that depth there is a rich fauna.

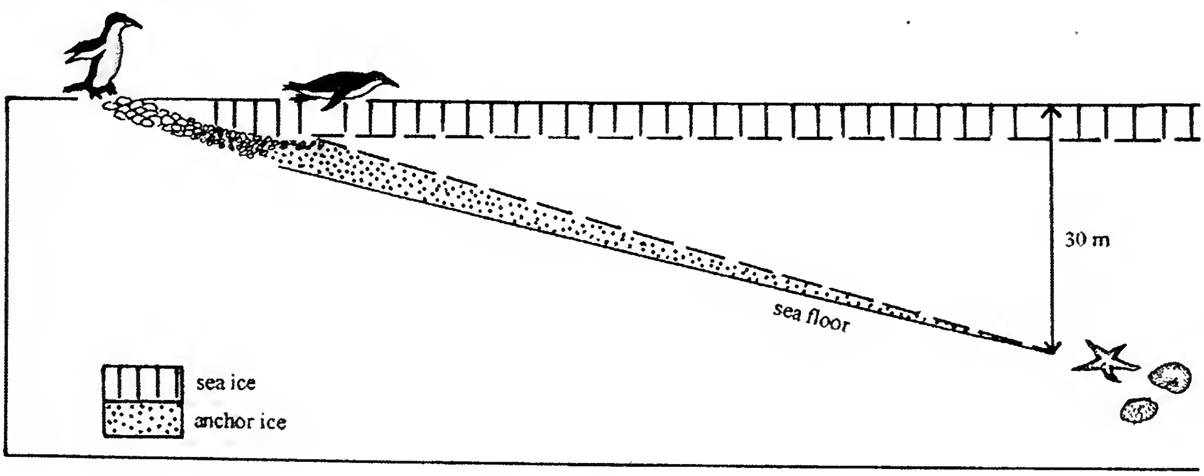

Fig. 3. Diagram of anchor ice.

I hoped to collect some of the sediment from *Andrea*'s anchor, more emails were sent, personal approaches made and containers distributed on board! However, often the ship did not anchor but motored around while Zodiacs took passengers ashore. Even when she did anchor, the sediment is mostly glacial till so it didn't stick to the anchor. I did however get great support from the Croatian mate who, despite little English, willingly gave me latitude and longitude as we left each location.

An unexpected source of molluscs was penguins! They eat *Nacella* whole, the animal is digested in their acid stomach then the shells are regurgitated later in a small pile around the penguin colony, sometimes 1 km from the beach. Although an exciting find, these are not Shell Show quality due to etching by stomach acid! We did see, tantalisingly close, hundreds of living *Nacella* from the Zodiac but the rough conditions made collection impossible. Maybe the ones that live tightly packed in crevices on exposed rocks don't get eaten by the penguins (or collected)!

South Shetlands

After taking obligatory photos of noisy chin strap penguins I searched low tide to find *Nacella magellanica* living on rocks under seaweed together with a predator muricid,

Acanthina monodon (Fig. 2). Amongst the seaweed were very active, huge, red amphipods measuring up to 30 mm. An algal wash revealed a micromollusc, *Eatoniella* which appeared to me to be identical to *E. kerguelenella chiltoni* found at New Zealand's Subantarctic Islands.

South Georgia

The ship sailed from the Antarctic Peninsula to South Georgia crossing the Antarctic Convergence where the Antarctic waters with a temperature of 0°C, meet the warmer waters of the Atlantic, Pacific and Indian Oceans. North of this convergence there is a noticeable increase in water and air temperature and the winters are not so severe, so I was hopeful of better collecting. At St. Andrews Bay a few regurgitated *Nacella concinna* were in piles around the extensive king penguin colony of 150,000 pairs. These limpets were large and low in profile (Fig. 2).

On one shore excursion at South Georgia I declined to view yet another penguin colony in order to explore every habitat at low tide. I braved aggressive fur seals and piles of ragged, moulting elephant seals all to no avail, not finding a single mollusc. On a later stop at the tiny town of Grytviken the more sheltered shore promised much, but a paltry one to two species were all the reward. So much for the hard won export permit!

Scotia Arc

From South Georgia to the Falkland Islands *Andrea* followed the submerged volcanic Scotia Arc along the plate boundary. Zelaya (2005) describes total of 73 shallow water bivalves, including 18 undescribed species and new records for a further 51 species. The only place where Scotia Arc is above sea level is at Shag Rocks.

Falkland Islands

Stanley

At last, the slightly warmer habitat was home to a diverse fauna. Stanley township had a long shore line mostly protected by a sea wall but it was possible to climb down in places to hunt through the wash up. A howling gale was unpleasant and the intertidal zone had its pollution problems highlighted by an overgrowth of sea lettuce, *Ulva*. I discovered after I had been wading around, that Stanley sewage is soon to be treated, but currently is released directly into the sea! The Harbour Master, a diminutive lady in the Museum, told me she has lived in Stanley for 40 years and has fond memories of playing on pristine beaches with her brother. They used to find a wealth of marine life including pink keyhole limpets. Fortunately I still found a range of marine species to collect such as barnacles, crabs, amphipods, isopods and marine worms.

West Arm

During a visit to West Arm, passengers walked over the privately owned island to enjoy nesting activities of black-browed albatross and rock hopper penguins among alpine vegetation. Returning from the walk I managed to collect briefly on the shore, when this started to prove lucrative with finds of a slipper shell *Crepidula* and bivalve *Gaimardia,* I became very deaf when called to board the zodiac! In a book on the Falkland Islands on *Andrea* it said *Gaimardia* live attached to kelp just off the beach. The dazzling white quartz sand looked out of place on a semi- sheltered beach.

New Island

The best collecting of the trip was at New Island on the west side of Falkland Island. I gave penguins a miss as fortunately we were ashore at low tide. Intriguing fragile white

bivalves were washing in. The identity of these baffled me long after the trip so I sent some to Richard Willan who identified them as *Erodona mactroides.* They live in fresh or brackish water so must have washed down a stream nearby, though neither Heather nor I could recall seeing one. A rocky area had plenty of turnable rocks. The gale force wind made collecting a challenge as specimens tended to get snatched from your hand! Here I saw live keyhole limpets *Fissurella picta* with their oversized body attached under rocks (Fig. 4). To my delight some were pink, just like the harbour master had remembered at Stanley when she was a child.

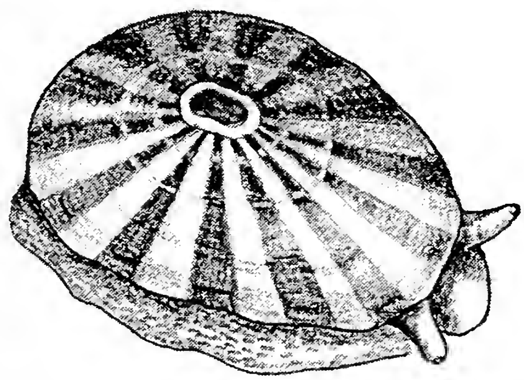

Fig. 4. A living *Fissurella picta* New Island, Falklands Islands.

Andrea's marine biologist Gustavo joined me turning really big boulders revealing a diverse fauna of crabs, isopods, amphipods, sponges, worms, anemones and molluscs. The molluscs included a large buccinid, *Pareuthria* sp., *Nacella fugiensis, Crepidula dilatatus,* and small *Margarella* sp. among the seaweeds. A few large specimens of live *Trophon geversianus* were attached under rocks and overhangs. Familiar blue mussels, *Mytilus galloprovincialis* dominated a wide zone of the intertidal rocks. Ribbed mussels, *Aulacomya atra* were common near low tide. Large white bivalves *Humilaria exalbida* were washing in (Fig. 2). Bags of sediment and algae revealed micromolluscs were present e.g. *Paxula, Mysella, Powellsetia* and *Neolepton.* On high tide rocks were tight clusters of attractively ribbed *Kerguelenella lateralis (*Fig. 2). This wide-spread species lives from Macquarie Island to South America, South Georgia and the Falklands (Powell 1979 p. 293).

On my return to Auckland airport gremlins had struck, my bag, plus all my specimens, was nowhere to be found.To my intense relief several days later it reappeared allowing sorting to commence. Live taken specimens were put into ethanol for Auckland Museum's wet collections, others cleaned for the dry collections. Most have now been identified, all are being accessioned to produce labels and finally put safely into storage. Collecting is the easy part!

Discussion

Despite being on the other side of the world some of the species found were familiar from visits to the South Island, or New Zealand's Subantarctic. e.g. *Mytilus galloprovincialis, Aulacomya atra, Kerguelenella* aff. *lateralis.* The buccinid *Pareuthria* sp. has close affinities with *Pareuthria campbelli* found on Campbell Island (Fig. 2). Both species have a dull grey exterior and dark aperture, but those from Campbell Island do not have prominent axials or the strong shoulder of the Falkland Island specimens. These New Island specimens were common under low tide rocks, the largest measuring 40 mm in height. The small bivalve *Lasaea hinemoa* living in crevices in the wall at high tide in Stanley, Falkland Islands looked identical to the species that lives in a similar habitat in New Zealand. The affinity of some of these species may be due to dispersal in the Circumpolar Current.

The *Potamopyrgus* specimens found on the shores of Lake Argentina appear to record an extension of published range. Powell (1979) recorded the genus *Potamopyrgus* from New Zealand and southern and eastern Australia. He mentions that the species "*P. jenkinsi*",

common in Europe, is thought to have been accidentally introduced from New Zealand or Australia. The range across Europe continues to extend and has been found in the Czech Republic (Cernohorsky 1995). Harris (1996) recorded *Potamopyrgus antipodarum* in Yellowstone National Park, United States in 1981. The suggested methods of introduction are maritime transport or fish both ruled out for the Lake Argentina population. Specimens may attach to birds, which seems to be the most likely agent in this case. Large flocks of water-birds of several species were feeding on the lake and its margins. Bird migration routes or DNA study on the *Potamopyrgus* may trace the origin of this introduction.

A few identification problems require more work, this is made more difficult as there is sparse literature on intertidal species. There also seems to be different names for the same species, depending on which reference you use. *Nacella magellanica* appears to be a very variable species, the specimens from Antarctica having subobsolete radial ribs while the South American specimens are more strongly ribbed. The interior is a rich chocolate bronze often with white rings and flecks. A reference book on *Andrea* called the Falkland's limpet *Nacella deaurata*.

The specimens of *Trophon geversianus* washed up at Ushuaia, Argentina and at Stanley, Falkland Islands, showed a series of specimens with sculpture ranging from spiral to clathrate but appeared to be all the same species (Fig. 2). The specimens of *Septifer bifurca* found living at high tide at Stanley could be juvenile *Aulacomya atra*.

The meagre collection from the Antarctic Peninsula was not a surprise, but I had hoped South Georgia would prove to have more mollusc species. However, Zelaya (2005) on the basis of data from different invertebrate taxa includes South Georgia (part of the Scotia Arc), in the Antarctic region.

I collected sediment samples from all locations but the only ones containing foraminifera were from the Falkland Islands and they were almost entirely composed of *Elphidium,* the most common intertidal genus globally (Bruce Hayward pers. comm.).

Conclusion

Heather, Alison and I highly recommend this amazing trip giving a brief taste of the Antarctic Peninsula. We were overwhelmed with the splendid isolation and vastness, both when viewed from the ship, on our frequent shore visits and during Zodiac cruises. Your luggage will not be over burdened with specimens, but the unsurpassed splendour of watching glaciers calving, gasping at unbelievable icebergs of cathedral proportions which glowed deep blue in their crevices as if lit from within, and vast penguin rookeries with a backdrop of snowy mountains, is more than enough compensation.

Acknowledgements

Many thanks to Heather Smith and Alison Stanes for providing much needed unwavering support during the trip; Bruce Hayward for suggesting improvements and formatting the article; Hugh Grenfell for drafting the map; Ashwaq Sabaa (Geomarine Research) for scanning my drawings; Richard Willan for identifying the bivalve *Erodona mactroides;* and Wilma Blom for identifying *Chilina gibbosa* and *Pareuthria* sp.

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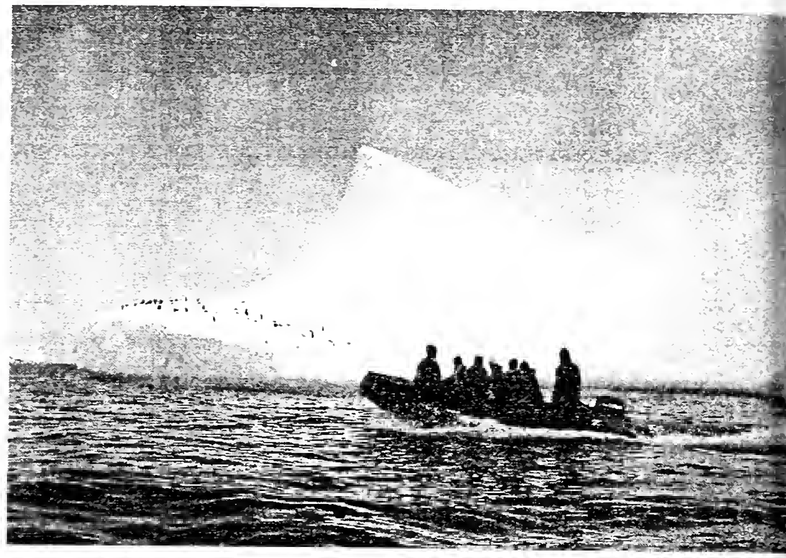
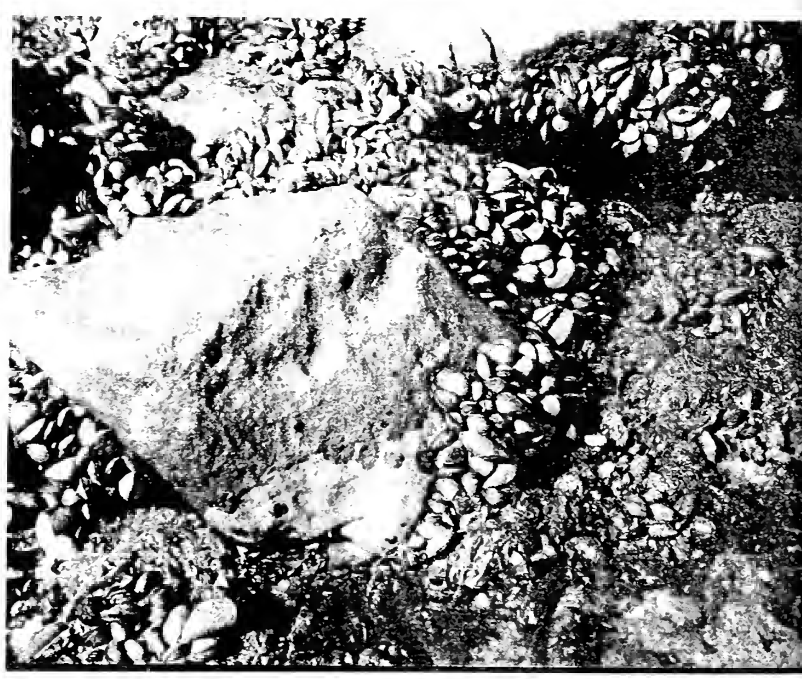
Ushuaia, Falklands, South Georgia, Antarctica Jan 2007	Lake Argentino, Calafate, Argentina	Ushuaia, Argentina	Ensenda Bay,Beagle Channel	Yalour,Antarctica Peninsula	Half Moon Bay, South Shetland Is.	Gold Harbour, Antarctica Peninsula	Hercules Bay, Antarctica Peninsula	St Andrews Bay, South Georgia	Stanley, Falklands	West point, Falklands	New Island, Falklands
o=occasional, f=frequent, c=common											
d=dead, dd=common dead, AW=algal wash											
Polyplacophora											
Mopalia laevior									d		
indet. chiton											o
Gastropoda											
Acanthina monodon					o						
Chilina gibbosa	c										
Crepidula dilatata										d	o
Eatoniella kerguelenensis chiltoni					cAW				oAW		cAW
Fissurella picta									d		o
Kerguelenella aff. *lateralis*									d		c
Laevilitorina caliginosa		c							dd		
Margarella sp.									d		fAW
Nacella concinna								f			
Nacella decurata									d		
Nacella fuegiensis											o
Nacella magellanica		o	d	d	c	d	f		dd		
Pareuthria sp.		d							d		f
Patelloida sp.		d									
Paxula transitans											d
Planorbis sp.	o										
Potamopyrgus? sp.	c										
Powellisetia sp.									fAW		
Siphonaria sp.		o							c		
Siphonaria sp.1		o							c		
Succinea sp.	c										
Trophon gevesianus		dd							d		o
Bivalvia											
Aulacomya ater									d		o
Erodona mactroides									d		dd
Gaimardia sp.										d	
Humilaria exalbida		d	d						d		d
Kidderia aupouria aff. *fiordlandica*									d		
Pisidium casertanum	c										
Lasaea hinemoa									c		
Mysella arthuri											d
Mytilus galloprovincialis		d	dd						c		c
Neolepton sp.									oAW		
Septifer bifurcatus		d							f		
Crustacea											
barnacles		c							c		c
crabs									c		c
amphipods		o				o			o		c
isopods		c							c		c
Pycnogonida											
pycnogonids									o		
Echinodermata											
sea urchin		d									
sea stars		d									o
Polychaeta											
marine worms		o									o
Sipuncula											
peanut worms									f		
Algae											
Macrocystis pyrifera										c	
Ulva sp.		a							c		c
brown unicellular in snow				c							
green unicellular in snow				c							

Antarctic Experience January 200





Keppel Bay and Townsville Shows 2007

By Heather Smith

What outstanding Shell Shows Keppel Bay and Townsville manage to organise each year. In 2006 I attended these shows for the first time and enjoyed every minute. So it was with great excitement I began organising another trip across the Tasman. Last year I flew to Rockhampton and met Bob and Betty Grange and drove from Keppel Bay to Townsville with them. Picnic lunch of king prawns on the pink gingham tablecloth was an unforgettable experience. This year I wanted to drive from Brisbane through to Townsville so I put out a message to Auckland and Wellington Clubs to see if any one wanted to join me. Jenny Raven President of Wellington Club responded.

After very early morning flights from Wellington and Auckland, Jenny and I meet at 9.00 am on Tues. July 10th at Brisbane Airport. We hired a Toyota Corolla. To my horror Jenny announced she'd only slept for 2 and half hours the night before. She was afraid she wouldn't wake up with her alarm so she stayed awake. I had done exactly the same thing in Auckland! So with very little sleep between us we set off for Bundaberg. I drove out of Brisbane. Then Jenny drove while I slept and I drove while she slept. We lunched at Mooloolaba and then on to Bundaberg. Allan Limpus met us at the grave yard! We followed him back to his home where we were spoilt for the next two days. Joan cooked up local dishes of scallops and local fish. Allan showed us his amazing collection of volutes and took us on a tiki tour of Bundaberg. Eng arrived from Singapore so more shells were enjoyed. We also visited the Henkes and saw their collection of shells.

Thursday we headed for Yeppoon. Shell World is a shell collectors dream. It's a must see for anyone interested in shells. And Ena is so amazing having a house full of 6 guests while she is so busy working at Shell World and helping with the show arrangements. Friday morning saw me dropped off at the Keppel Bay Town Hall while Jenny was off to explore the beaches. It was wonderful meeting up with all the local members again. You are so good to us Kiwi's. Fortunately my shells had all arrived in tact and I set about with many others organising entries. Jean and Diane did a great job marking out where all the entries were to go on the newsprint paper and the many tea towels hanging from the tables all go towards making a successful display. It's great fun seeing each others exhibits and I think we all spend a little time pretending to be judges! Personally I think the judges can have their job! I congratulate them all on the time they put in and the choices they make. For me, I greatly appreciate their professional decisions and comments they pass on to us both verbally and on those little marking sheets! There were many outstanding exhibits and sometimes there must be 3 firsts but some how they have to choose one! This year Dr Mike Hart was given the honour of opening the show and presenting the trophies. He gave an impressive speech on shelling and let us know that there are many contributing factors to the demise of some shell species. Many, many people spent time admiring all the exhibits. As for the exhibitors, we had a busy time talking, looking at all the competition and wheeling and dealing with all those dealers! How do they manage to arrive with more beautiful shells each year? I think they see me coming! I'm so easily tempted when I see a beautiful shell!

It's such a novelty to be picked by a bus for Saturday night dinner at the bowling club! What a service! The multi drawer is always a success with heaps of laughter. It's great to have everyone there! Dealers, exhibitors, organisers, friends, travellers, locals and the hard working committee. What a great night and you can even drink as much as you like and get the bus ride home!

Sunday comes all too quickly and before you know it, it's time to be packing up. Some of us have great difficulty getting every one of those shells packed before the tables need to go be put away. And then it's time to say goodbye and for lots of us, a move on to Townsville.

Jenny and I spent three nights with the Bob and Betty at Dingo Beach. It didn't yield too many shells but we had some lovely walks and saw some amazing sunrises and sun sets.

On to Townsville. I had a lovely surprise. My daughter and her partner who live in Sydney happened to be attending a wedding on Magnetic Is the same weekend as the shell show! So Friday morning saw us heading to the airport to spend 30 minutes with them! She's getting married in Sydney on the 1st of Sept. so it was the last time I'll see her before the wedding. Then it was on to the Orchid Rooms to meet all the Townsville members and set up more trays of shells with many

other contestants. Once again the standard of trays was high and I thanked my lucky stars that I wasn't judging. It's amazing how an empty hall can be transformed into such a wonderful Shell Show. The pot plants on the tables looked impressive and contribute to a great show. While the judges went into action I spent a delightful Friday evening having dinner at Bev Swan's with Grace Lum Wan and Marg Peach. All day Saturday the Orchid Room buzzed with people talking and viewing the exhibits. I was happy to shop with the local dealers and appreciate picking up some Australian Shells. Paul and I seem to be having our own little competition with Cowries and Pectens. All in good fun of course! Then off to the Pub for a delicious dinner and the first Multi Draw Raffle. Those of us who had to fly home breathed a sigh of relief when the big items went to local people! All a load of entertainment. Sunday was another busy day ending with the Shell related Multi Draw and the busy pack up of shells. A quick goodbye and back to the motel to repack and be organised for a 4 am trip to the airport next morning. The sunrise on the flight from Townsville to Brisbane was stunning.

Back to N.Z. by 3.00 pm and I've been in a classroom ever since!

The BIGGEST THANK YOU to all those Aussie Conchologists who go out of there way to make us Kiwi's feel so welcome and give us such a great time. I'll be back!

The next challenge is the Australian National Shell Show in March 2008 in Brisbane. We plan to be there and look forward to catching up with you all again!

Happy shelling! Heather Smith.

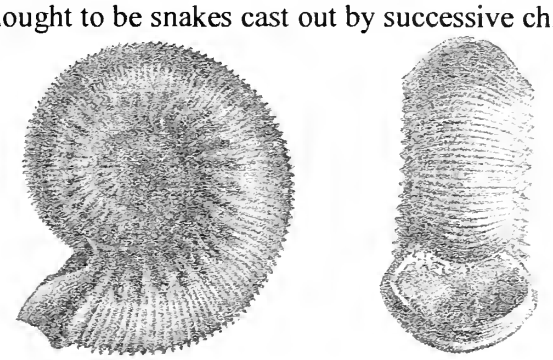
Top: Keppel Bay Judges.
Bottom Left: Jenny Raven and her collection.
Bottom Middle: Dr Mike Hart and Val Hart
Bottom Right: Allan Limpus with his volute collection.

FIGURED STONES

MICHAEL K. EAGLE

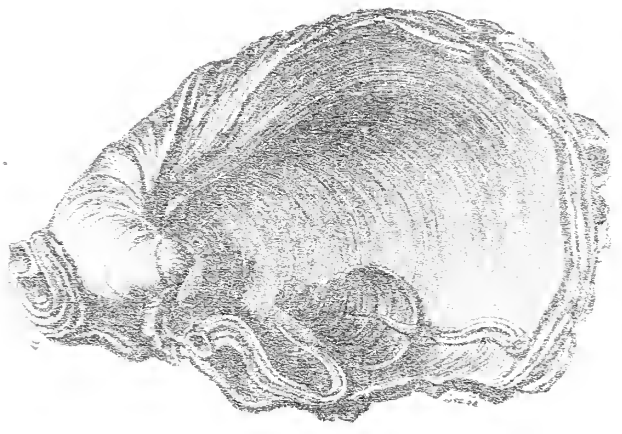
Fossils have piqued people's imagination for thousands of years. They have been objects of fear and wonder, lucky charms and medicinal cures. When geological science was in its infancy and fossils were known only as "figured stones" the Christian Church attempted to address their curiosity value through study and interpretation of Holy Scripture. Fossils were assigned exotic names in the course of many attempts to explain their existence, and these were widely used in Europe by professional and lay person alike. Curiosities of bizarre shapes and sizes, interesting sculpture, some rare, often seemed to magically emerge from the ground. To describe them from one another, they were prefixed with words like 'tongue' or 'toe' because they resembled parts of the human body, so that some became associated with the practice of sympathetic medicine – curing like with like. Animals, both mythical and real also featured in the vocabulary of the time.

Invertebrate mythical names were the most numerous. Ammonites (or *Cornu ammonis*) were once thought to be the curled horns of a Greek god, Ammon. Because of their weird, nacreous, sometimes iron-pyritised and variously sculptured shells, ammonites were known as 'snakestones'. Snakes and serpents were seen as devilish, requiring eradication prior to building a sacred place. Originally, 'snakestones' were thought to be snakes cast out by successive christen saints at St. Hilda, the Saxon abbess of Whitby, England, who purged them all prior to building the abbey, then dedicated it to St. Patrick of Ireland (a country devoid of snakes). In India, ammonites were kept in temples by Hindus to help purify water and these from 'float' material obtained from the Gandaki River in Nepal were known as 'saligrams'. They were believed to be the discus or 'chakra' held in one of the six hands of the god Vishnu. Devonian brachiopods in China were known as Shih-yen, or 'stone swallows', which were said to be able to fly during thunderstorms. 'Stone swallows' were also thought to capture a spirit in anguish and to be able to free it, bringing peace and prosperity to the owner.



Ammonites humphresianus **from the Jurassic Inferior Oolite of England.**

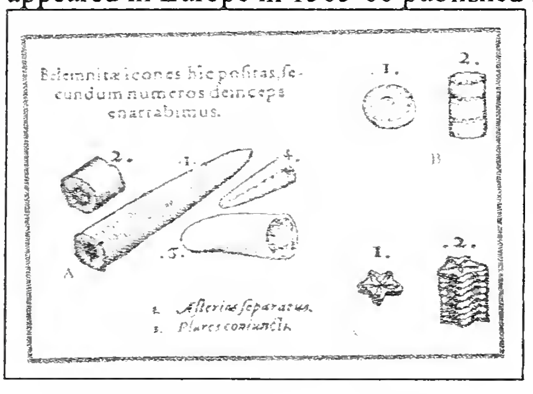
The contorted, curved shells of the extinct, European, Jurassic oyster *Gryphea arcuata* were thought by English commoners to be the 'devil's toenails'. Specimens unearthed when digging or seen as objects in scree on frittering cliff faces and open hillsides were thought to represent the manicured clippings. In other parts of the country, (mainly because of the inflated beak) they were also thought to be the swollen, arthritic



joints of spirits and particularly in Scotland were used in a sympathetic-medicine approach in an endeavour to cure joint pain in people. *Gryphea arcuata* was also called 'crouching stones', 'cuckoo shells', and Milner's thumbs. Milner's thumbs according to the entry of 10 April 1696 in the diary of Abraham de la Pryme, were burnt and powdered shells of *Gryphea arcuata* capable of curing the sore back of a horse in two or three days.

***Gryphea arcuata* with fossil *Serpula* worm tubes.**

The guards of extinct belemnites (a fossil squid-like cephalopod), were known by many names in Europe in the 14th to 19th Centuries. The first published accounts of cephalopods (and crinoids) occurred in the later half of the sixteenth century, well before the establishment of modern systematic nomenclature later instituted by Linnaeus in 1758. Subsequently, literature from this period has been largely ignored. Faithfully rendered woodcuts illustrating stellate and round forms of belemnites (and crinoids) first appeared in Europe in 1565-66 published in Conrad Gesner's *De Rerum Fossilium.*



Belemnites look like the sharpened tips of spears and lances; partial specimens like modern bullets. They have been variously known in the past as 'St. Peter's fingers', 'ghostly candles', and 'devil's fingers'. The ploughed fields of Norfolk chalk and Oxford clay of England in the Middle Ages surrendered thousands of belemnites, appearing as out-washed fossils after thunderstorms and heavy rain. Myths began with farmers that they were 'thunderbolts (lightening) shot to earth by heavenly gods and captured by the earth.

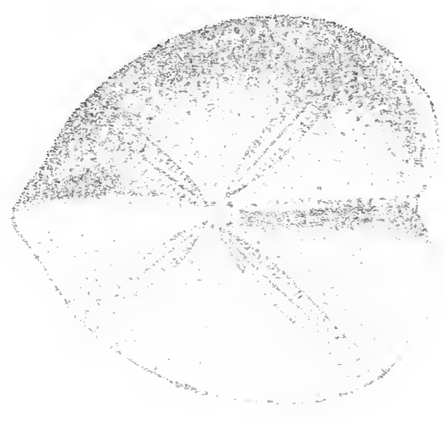
Woodcut from Conrad Gesner's "*De Rerum Fossilium*" illustrating belemnites and crinoids.

Fossil trilobites did not escape folklore either. Common throughout the world, these prehistoric arthropods invoked a mythical belief of medicinal properties and good luck. The trilobite *Calymene* was once quarried and mined from limestone in the vicinity of Dudley, England. It was so abundant that during the 18th Century miners supplemented their incomes by selling them as curiosities or lucky charms. They became locally known as the Dudley Bug and for many years appeared on the town's coat-of-arms. The Pahvant Indians of North America believed trilobites to be 'water bugs' and

An enfolded specimen of *Calymene blumenbachii* from the Wenlock Beds, Ludlow, England.

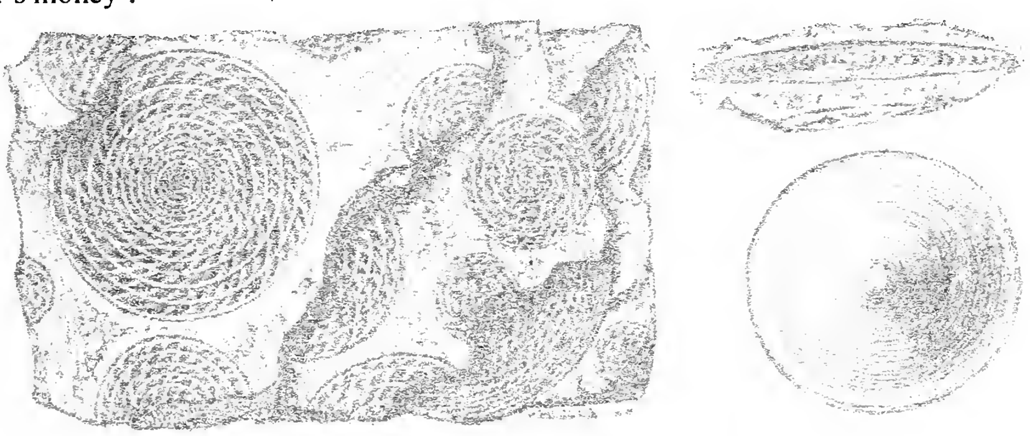
possessed medical properties if worn as a necklace. Their belief was so complete that they thought that 'water-bugs' could prevent any illness and render them immune from stray bullets during the Wild West era. Trilobites were also deemed to be demons by some South American tribes, who considered them spirits from the under-world living inside the earth.

Just as Christian Crusaders sewed the modern scallop *Pecten maximus* to their cloaks as a symbol of their participation in the Holy Lands, many collected Late Jurassic *Balanocidaris* (sea urchin) tests which they called 'jewstones' after the religion of the people living there. They were usually worn as lucky amulets. Apothecaries of ancient Egyptian communities dating around 650BC used to grind the inflated, bladder-like stones into powder to be used as a cure for urinary tract problems. Fossilised tests of spatangoid echinoids (also sea urchins) such as *Micraster* went by the name 'hearts' in the chalk districts of England. Peasants thought them the hearts of spirits inhabiting the land. Even Foraminifera feature famously in folklore. The Eygptian pyramids of Giza are built of Eocene and Oligocene limestone made up almost entirely of the disc or lenticle-shaped skeleton of the coiled, single-celled organism *Nummulites*.



Micraster coranguinum **from the White Chalk, Leske, England.**

Strabo the Geographer in the first century BC was told that they were the remnants of food fed to slaves whilst building the pyramids. Because some species are similar in size and shape to coins, they were also thought of by some Mediterranean residents as 'angel's money'.



Nummulites puschi **collected from Peyrehorade, Pyrenees.**

Vertebrates as well as invertebrates were described in this manner. In Japan fossilised shark's teeth of the prehistoroic great white shark *Carcharodon megalodon* (perhaps the largest predator fish to ever live at about 17 metres long), were thought to be the pointed thumbnails of Tengu Man, a mythical mountain goblin. Their similarity in shape and size of animal tongues, as well as their double serrated edges, led to the European idea that

they were the petrified tongues of 'devil-serpents'. Tonguestones were considered an antidote to poison. It was fairly common practice in British medieval times to dip tonguestones into a cup of wine given to one at a banquet or ball in an effort to neutralise the effects of a possible poisoning. Many tonguestones have been collected from the island of Malta and their evidence was used to support the folklore of St. Paul who was said to have been shipwrecked on the island in AD60. St. Paul was supposedly bitten by a snake that rose out of the fire built to warm and dry the shipwrecked sailors. He is supposed to have grasped the fiery reptile and flung it back into the fire, cursing all the snakes on the island at the same time. His action is deemed to have caused them to lose their eyes and tongues.

The extinct Jurassic and Cretaceous fish *Lepidotes* frequently lost hard, round, crushing teeth from their jaws. When fossilised, these teeth appeared like perfectly formed, little, blackened stones. The Roman natural historian Pliny the Elder in 23-79AD linked them to the legendary but mythical 'jewels' that were said to exist in the heads of toads, hence the name 'toadstones'. Toadstones', ground up and administered orally were generally thought a cure for epilepsy and an antidote to poison.

Tooth of a Charcharodon shark thought to be a'tonguestone'.

Embodied in early publications are the descriptions of objects dug from the earth in personal collections often purported to have medicinal uses. Perceived medicinal use of such fossils may have been an important factor for the attention that they received in sixteenth century publications. Little continuity existed from one author to the next, despite communications and mentor-student relationships. For example, living and fossil crinoids were not reconciled as one and the same at this time, since living comatulids were considered 'starfish', and fossil crinoid columnals deemed inanimate curios. It was only at the close of the 16th Century that crinoid circular and pentalobate stem columnals were recognised as relatives and incorporated into an artificial classification scheme. An ongoing fascination with these 'stone lilies', as well as many other collected stone curiosities, led people to believe they were shaped by unknown 'subterranean forces'. This idea persisted beyond Archbishop James Ussher's 1654 ecclesiastical calculations that the world was created in 6 days, being completed at 9.00 am on 26 October 4004 BC. Somewhat undeterred by this edict, scientific exploration of the natural world continued to proceed and the realization that eroded landscapes and sedimentary strata represented vast amounts of time and inherent fossils, indicated an immense variety of life now known to be extinct. However, at this time (and for the same general ecclesiastical reasons) extinction was not accepted as having occurred; species not seen living were argued as existing elsewhere in the world and yet to be discovered. Two examples exemplify science of the period. A short paper by a Mr. Lifter published in the Philosophical Transactions (Abridged version published in 1802) of the Royal Society of London in 1674 remonstrates with Agricola (1494-1555) that his so called '*trochites*' or '*entrochi*' (fossil stalked crinoid columnals) otherwise known to the English as 'St.

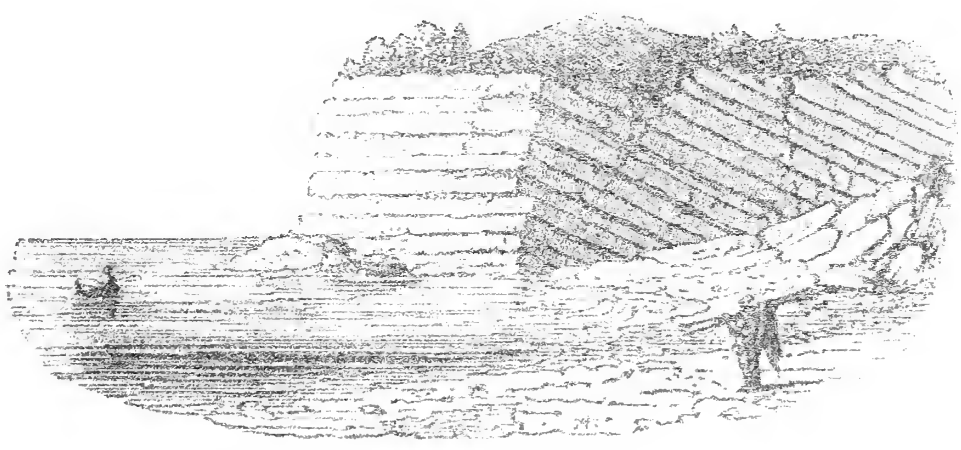
Cuthbert's beads' in Yorkshire or 'screw-stones' in Derbyshire are '*lapides informes*' with some specimens 'supposed to incrustate divers roots'. A further paper in the same journal by a Mr Beaumont in 1676 entitled "Concerning Rock Plants, and their growth" offers: " But I am inclined to the opinion, that these rock-plants are *lapides fui generis*, and not parts of plants or *animals petrified*.....and we cannot well imagine how so many species, diffused through many parts of the whole earth, should all together happen to be loft; so that, upon the whole, this seems to me a considerable objection against those who maintain that all figured stones in the earth are petrifactions of plants or animals; to which opinion *Steno*,

The crinoid *Pentacrinus fossilis* from the Lower Lias, Lyme Regis, England.

in his dissertation concerning solids naturally contained within solids, adheres". Steno was a physician in the mid 18th Century who lived and worked in Florence, Italy. It was he who first compared fossil and modern specimens after dissecting a large fish caught near Liverno in 1666 and proved that the tonguestones that fell out of rocks were in fact the teeth of ancient sharks.

The Scottish geologist James Hutton propounded the postulate of biostratigraphy in 1785, which was subsequently expanded by colleague John Playfair in 1802, but left to the English geologist Charles Lyell to expound in his massive work "Principles of Geology" published in 1830-1833. Advances in nautical technology in the 1800's enabled researchers to probe the sea in a scientific manner. Many marine phyla were netted and dredged, finally to be understood for what they were, 'living fossils'. Initially crudely helmeted divers, later scuba divers captured live individuals from shallow marine depths. Subsequent late 20th Century submersibles enabled observation and biological study of deep-sea animals. Taxonomic comparison of modern and ancient taxa, insights into their evolution, paleoecology, paleoenvironment, and paleobiogeography then began.

Acknowledgement: All illustrations are from Lyell's Students Elements of Geology (1874) with the exception of the woodcut from Conrad Gesner's "*De Rerum Fossilium*" (1565-66); no scales are implied.



The Perfect Habitat? Fauna living in empty *Bankia australis* tubes

Margaret S. Morley [1] Bonnie A. Bain [2]
1 Auckland War Memorial Museum 2 Southern Utah University

Even very familiar local beaches can sometimes produce a surprise. This was the case when walking from Bucklands Beach to Musick Point in the Tamaki Estuary, Waitemata Harbour on 20 June 2005. A large tree trunk had been washed in and was embedded in the sand at high tide level. I was hoping to find some of the teredo *Bankia australis* requested by Zvi Orlin. With a small knife I managed to chip away some of the wood riddled with the calcareous tubes created by *Bankia*, but it really required a larger tool to get a decent sample. In some desperation I took handfuls of the really rotted, squishy pulp on the under surface of the log. This rather revolting material was all dumped into a bag for later sorting.

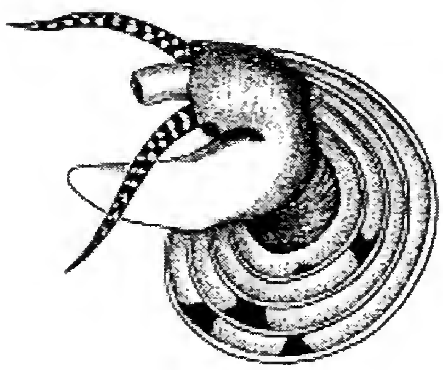


Fig. 1. ***Risellopsis varia*** **turning over, shell width 4 mm.**

Later that evening I examined some of the sample under the microscope. The damp tubes were perfect dark apartments for an amazing variety of organisms including the small littorinid snail *Risellopsis varia* (Fig.1). The body and proboscis were semi-transparent grading to cream and then chocolate brown on the dorsum of the head. The two long, finely tapered tentacles were delicately striped with zebra black and cream. Also present were the small curved tubes of *Caecum digitulum.* Both these species feed on filmy organic deposits (Morton & Miller p. 238) and more usually live in crevices. Another common inhabitant was the leathery slug *Onchidella nigricans.*

I had never seen so many of the small white gastropod *Leuconopsis obsoleta* -each family of up to ten specimens huddled together within an empty *Bankia australis* tube. When covered with sea water the animal crawled strongly away from light (Fig. 2), when moving in air the mantle was retracted and the tentacles constricted to narrow tubes. The off white, translucent body has a phosphorescent margin while a dark patch (of intestine?) can be seen through the body whorl of shell. When disturbed the aperture is sealed off by the foot as there is no operculum.

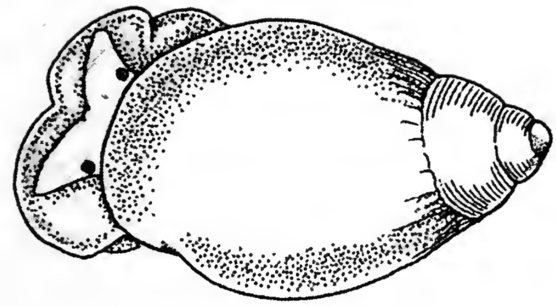


Fig. 2. ***Leuconopsis obsoleta*** **crawling in sea water, shell height 2 mm.**

Then suddenly I was watching four amazing creatures about 7 mm long moving like slow-motion stilt walkers on eight incredibly long legs attached to a segmented rod for a body. They were identified by Bruce Hayward as pycnogonids (Fig. 3). These ancient Arthropods in the Class Pycnogonida are mostly bottom dwellers, although some, such as the black and white *Stylopallene longicauda* from Western Bay, Vic, Australia are able to swim. Nearly all pycnogonids have four pairs of walking legs, but a few genera have either five (*Decolopoda, Pentacolossendeis, Pentanymphon, Pentapycnon*) or six (*Dodecolopoda, Sexanymphon*) pairs. Although called "sea spiders" their relationship to other groups is not well understood. Different species of pycnogonids have been observed feeding on a variety of marine invertebrate prey (Bain 1991) including cnidarians (e.g. anemones, medusae) molluscs (nudibranchs, mussels, lamellarians) and other soft bodied invertebrates as well as bryozoans, polychaetes, brine shrimp, and copepods. Juices of the host are sucked up with the proboscis on the head of the pycnogonid. These Musick Point specimens were well catered for by the presence of the green anemone *Isactinia olivacea,* the mud flat anemone *Anthopleura aureomarginata* and golf ball sponges *Tethya aurantium.* However Ruppert and Barnes (1993, p. 671) say that some pycnogonids feed on algae, microorganisms growing on hydroids or bryozoans, or even detritus.

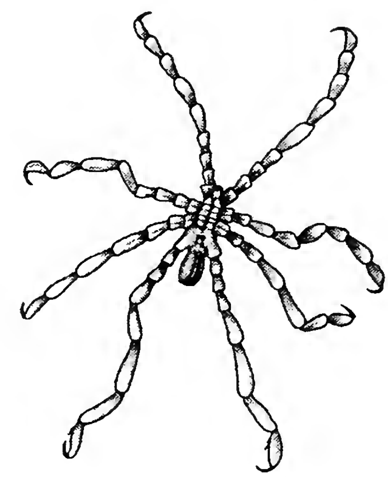


Fig. 3. Musick Point pycnogonid ***Anoplodactylus*** **sp., 7 mm measured between leg tips.**

Males (and most females) of nearly all pycnogonid species (except some species of *Pycnogonum*) have an additional pair of modified legs known as ovigerous legs which are used by the male to carry the eggs. Because the narrow pycnogonid body cannot hold all the internal organs, parts of the long intestine and gonads are situated inside the legs. Small pores over the entire body surface allow gas exchange (Davenport et al. 1987). Blood is pumped by the heart in blood vessels along the back and legs and blood also circulates freely within the body cavity (Smith & Carlton 1975, p. 721, 413-424). These vessels were visible in the living Musick Point specimens looking like the bones of a skeleton.

There are over 1400 species of pycnogonids living world wide from the polar regions to the tropics, exclusively in marine habitats. Over ninety species have been described from New Zealand. Some species live in depths of 7000 m, are huge, up to 70 cm in size and display gaudy colours (Fossa & Wilsen 2000, p. 189-193). The pycnogonid *Stylopallene longicauda* is poisonous to its predators (Sherwood et al. 1998). Many other species rely on their cryptic colouring to avoid predators. They have two pairs of eyes mounted on a tubercle, one pair looks forward and one pair backwards, both pairs of the Musick Point specimens gleamed with phosphorescence (pers. obs.). Each of the 8-segmented walking legs terminates in a propodus (foot) with a terminal main claw and many species also have a pair of auxiliary

claws at the base of the main claw which are most efficient at securing the animal to the substrate. When hurrying (at a snail's pace!) away from light they showed their ability to walk upside down.

Pycnogonids have separate sexes, mating occurs with the male upside down either under or on top of the female, resulting in a great tangle of legs! As soon as the eggs are laid, the male gathers them up, secreting a substance from a cement gland on his femur (1st long leg segment) to hold them in place on the underside of his ovigerous legs (Fig. 4). There can up to 1000 eggs in each cluster. Three of the Musick Point specimens were males and one a female. Two of the males carried up to six clusters of white eggs indicating that they had fertilized the eggs of several different females until the clusters extended across all their legs and abdomen as well. One cluster appeared to have been directly attached onto the surface of the wood.

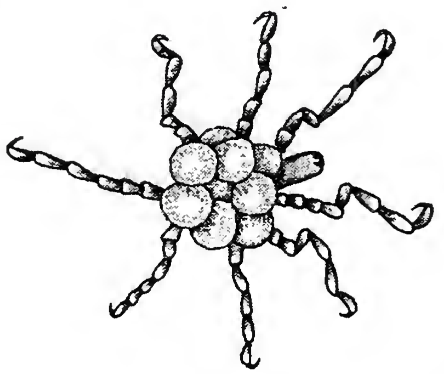


Fig. 4. The underside of a male pycnogonid *Anoplodactylus* sp. from Musick Point to show the attached egg clusters.

Many pycnogonid species (e.g. *Achelia, Ammothea*) have a free-swimming, feeding larval stage called a Protonymphon larva. Other species such as *Anoplodactylus* have an Encysted Larva which forms a cyst within a host organism such as a coral or a hydroid, undergoes much of its development within the cyst and only breaks free at an advanced stage of development. Larvae of still other pycnogonid species attach themselves to the male's ovigerous legs and undergo most of their development there, only leaving once they become juveniles. These Attaching Larvae, found only in the families Nymponidae and Callipallenidae, are filled with yolk and do not feed until they become juveniles and leave the parent for good. Metamorphosis takes place by a series of moults, adult appendages are added with each moult (Smith and Carlton, 1975, p.721, 413-424; Bain, 2003a, b).

The pycnogonid specimens remained alive in sea water for nearly two weeks. There were no changes observed in the eggs. They are now in the marine collections at the Auckland War Memorial Museum. Co-author Dr Bonnie Bain, a specialist in pycnogonids at Northern Arizona University, has identified these specimens as *Anoplodactylus* sp. (AK116783) and a second species as a variant of *Achelia dohrni* (Thomson, 1884) which were found a few days later in the same log at Musick Point (AK 116791).

This second species was quite different, much smaller average size (about 4 mm) with shorter legs, a round body, pedipalps (non-walking legs) and were less active (Fig. 5). The eye tubercle was smaller and taller. They clung closely to the wood with a flattened posture making them very hard to spot. They had, at the end of each walking leg, a terminal claw and a pair of auxiliary claws. The largest specimen, about 6 mm, was carrying egg clusters on his ovigerous legs. A species of thecate hydroid was common in the wood providing a possible food source, and the segments of the pycnogonid legs matched the hydroid thus providing excellent camouflage.

Although over many years, I have examined numerous bags of shell sand, dredged sediments and material from rock and algal washes, I had never seen pycnogonids before. To

my amazement the very next week while looking at algal wash from Cudlip Point, south head of Mahurangi Harbour, I saw a single 3 mm specimen. It is easy to see how the mottled, nondescript brown colour and unremarkable shape could be overlooked or mistaken for algae or detritus. It had only been the movement in sea water that had originally caught my eye. Probably if the sediments are dried before being examined the animal disintegrates. My experience of seeing another pycnogonid so soon after the first, illustrates a valuable lesson that studying the features of any species "gets your eye in" and greatly increases your chances of future success (Morley, 1981). Since then I have found living pycnogonids less than 2 mm in most samples of alga and rock washes taken from beaches in the Auckland area.

Pycnogonids are living in Fiordland under *Ecklonia* kelp with an average size of 60 mm, they are usually bright yellow (Tony and Jenny Enderby pers. comm.).

In the second sample of wood taken, after much sorting, I finally found the teredo, *Bankia australis* valves and pallets which had started the discoveries of the fauna in wood.

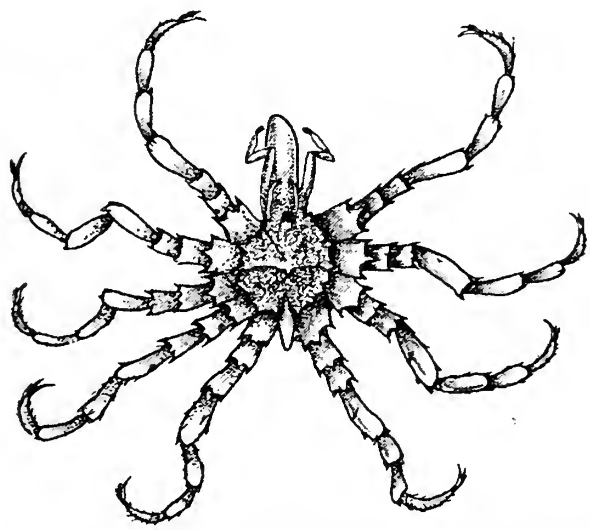


Fig. 5. Pycnogonid, *Achelia dohrni* Thomson (1884), 4 mm between leg tips. Note pedipalps.

List of organisms found in the tubes in wood (Fig. 6)

Chitons
Acanthochitona zelandica
Sypharochiton pelliserpentis

Bivalves
Bankia australis
Lasaea hinemoa
Ruditapes largillierti juvenile
Limnoperna pulex previously *Xenostrobus pulex*

Gastropods
Eatonina atomaria
Haustrum scobina- previously *Lepsiella scobina*
Leuconopsis obsoleta
Risellopsis varia

Pycnogonida, sea spiders
Anoplodactylus sp.
Achelia dohrni Thomson (1884)

Crustacea
barnacle *Austrominius modestus*
larvae of arthropod
Isopoda *Isocladus armatus*

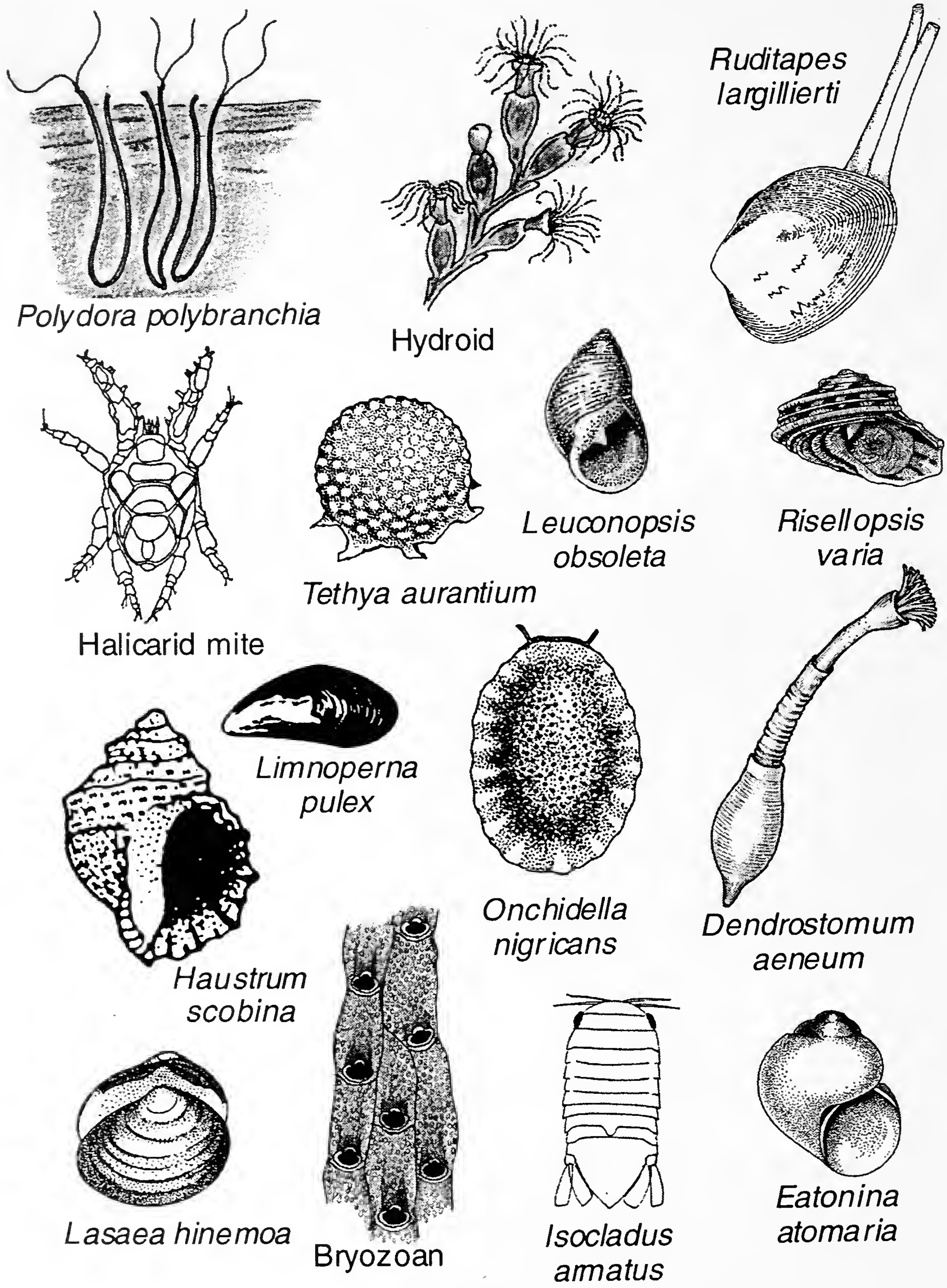


Fig. 6. Species living in empty *Bankia australis* tubes. Drawings by Powell (1979), Morton & Miller (1968) and Margaret Morley.

Porifera
golf ball sponge *Tethya aurantium*
Bryozoa
Foraminifera
Rosalina bradyi
halicarid mite
marine worms e.g. spionid worm *Polydora polybranchia.*
Sipunculida peanut worm *Dendrostomum aeneum*
Algae
Boodlea mutabile
Chaetomorpha sp.
Gigartina chapmanii

Acknowledgements
Thank you to Bruce Hayward (Geomarine Research) for identifying the foraminifera and formatting the article, Ashwaq Sabaa (Geomarine Research) for scanning the figures, Tony and Jenny Enderby for data on pycnogonids in Fiordland and Todd Landers (Auckland War Memorial Museum) for mailing specimens to the States.

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"The Beautiful Shells Of New Zealand" by E.G.B. Moss
A book review by Ian Scott

Recently while looking through the wares of a secondhand book store I came across the above book which I had never seen before. It was published in 1908 making it almost a hundred years old! It includes ten black and white photographic plates illustrating the shells. Mr Moss was an Auckland barrister who did his collecting in the Tauranga area over a period of twenty years. This book was the first attempt to publish a popular book on New Zealand shells written by an amateur for amateurs.

On reading it I find that many things have not changed! He writes: "For some inscrutable reason, however, the New Zealand authorities are continually changing the classical names of our shells.....It is really time some attempt was made to stop this foolish proceeding. Most of the shells, since I began collecting 20 odd years ago, have had their names changed once, many of them twice, and some even three times." If he could see the present names he would see that this has continued after his publication! See which of the following names from his book that you can identify:

Purpura succincta
Scaphella pacifica
Dolium variegatum
Euthria lineata
Cominella testudinea
Lotorium cornutum
Ethalia zelandica
Astralium sulcatum
Surcula novae-zelandiae
Haliotis rugoso-plicata
Chione crassa
Volsella australis

The answers: *Dicathais orbita, Alcithoe fusus, Tonna cerevisina, Buccinulum linea, Cominella maculosa, Cymatium (Turritriton) exaratum, Zethalia zelandica, Turbo smaragdus, Phenatoma rosea, Haliotis australis, Tawera spissa,* and *Modiolus areolatus*

And how about this for cleaning shells: "Soak the dead shells in hot water for a few hours to get rid of the salt, and then scrub with a hard brush, or, if encrusted or very dirty, rub with sand using a brush or cloth. No need to fear hurting them, unless very fragile, in which case the best thing is a soft toothbrush with fine sand.......then rub the shell with a mixture of sewing machine oil and chloroform in equal parts. The machine oil, being fish oil, will replace the oil the shell has lost, and chloroform is the best restorer of colour we have."

There are many other fascinating bits of information in this book and it really is a window into shell collecting a hundred years ago. Look out for it when visiting second hand book shops.

LAST FOUNDATION MEMBER OF CONCHOLOGY SECTION DIES
David H. Baker 26 November 1916 – 3 September 2005

David was a foundation pupil at Kohimarama School, then attended Auckland Boys Grammar. At the age of 14 he became a foundation member of the Conchology Section at the Auckland War Memorial Museum. He maintained this association with the museum throughout his life and built up an impressive shell collection. For many years he was a volunteer guide at the museum.

After leaving school he worked in the father's joinery business. He then went to the Solomon Islands and New Hebrides (Vanuatu) with the Melanesian Mission, returning to Auckland to join the army in 1940. He rose to the rank of Lieutenant at Army Headquarters.

David joined the New Zealand Valuation Department in 1948, becoming District Valuer for South Auckland in 1952, a position he retained until his first retirement in 1977. He then worked as a consultant for a further 12 years for two of his younger colleagues from the department.

He married Sylvia in 1941 and they had five children. Sylvia died in 1965. In 1966 he married Margaret and they had two children.

David had a close association with the Parish of Kohimarama throughout his life and especially with the construction of the two new churches St Andrews and St James in the 1950s.

He loved the outdoors and travel, and in the summer would often swim the length of Mission Bay and back again. He also enjoyed cycling, walking and reading and had a long association with the Anglican Trust for women and children, the Melanesian Trust Board and Probus. His love of nature led to him being made honorary ranger for the Orakei Bush Reserve. His travels took him to a number of interesting places. A cruise included L.A., Chile, Falkland Islands, Argentina, Brazil and six of the Caribbean Islands. Other places visited included Australia, Lord Howe Island, Norfolk Island, Tonga, Philippines, Greek Islands and New Caledonia.

Heather Smith and Doug Snook jointly purchased his collection. The proceeds were evenly distributed to the Anglican Church, the Anglican City Mission, Save the Children Fund and the Anglican Trust for Women and Children.

Bruce Hazelwood 5 January 1949 - 31 December 2005

Bruce was a member of the Conchology Section of the Auckland Museum Institute for over thirty years. He first joined when he was living in Otaki, Wellington and later shifted to Hamilton. In 1987 he shifted to Ellerslie and began attending our meetings regularly.

Bruce had a keen interest in his shell hobby. His major family of interest was worldwide volutes. Other families he focused on were Nassarius, Miters and Turrids. He also enjoyed collecting landsnails from almost any bush reserve. Jim Goulstone shared his knowledge and often collected with Bruce, who gained considerable knowledge of species from Jim. He knew a lot about chitons which he collected from far and near and was keen to bid at auctions for any that may be offered, especially from overseas. He was not comfortable leading a meeting, but when encouraged was able to give an excellent lecture that reflected his interest and knowledge. He served as a Vice President for several years and was currently on our committee. He was always willing to help when required at the shell auctions and shell shows.

Bruce had major open heart surgery and two heart valves fitted which slowed slow him down a bit. He sold his car, but still went on a number of field trips. Bruce was at a family get together in Tauranga when he died suddenly on New Years Eve. His funeral took place on his 57th birthday 5th January 2006.

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Conchology Section Auckland Museum Institute
Incorporating Auckland Shell Club

INSIDE THIS ISSUE

EDITORIAL

Welcome to our Spring 2009 issue, containing inspiring, informative articles from a wide cross-section of our members, dedicated scientists to amateur enthusiasts. Regretfully, this issue is long overdue because of lack of articles, until recently. This is the first compilation of a new team of volunteers, Jan Munroe and myself. We are gratified by the response to our request for articles, all contributions are appreciated and of interest, rest assured.

The profound mysteries of nature are demonstrated in a deeply moving account of personal observation, in the thought provoking *Cassis cornuta* story. Who could not feel unease about taking the life of a living mollusc, in future?

Recently, I attended a lecture on the development of underwater sonic recordings, through the war years with all their waterborne threats, to the songs of whales and dolphin speech, detection of underwater volcanoes and general shipping. A puzzling mystery was a significant dawn chorus, which was eventually revealed to be the early daylight browsing of abundant *Evechinus chloroticus*, with their busy mouthparts grazing algae on oceanic meadows.

This issue features a comprehensive obituary, which is a fitting tribute to the life work of Norman Gardner—a modest man with mammoth achievements and to whom I wish to dedicate this issue of "Poirieria". It is never too late to share tributes of this nature.

Let us have some "Letters to the Editor" pages—send in your comments, photographs, observations, memories of past events and people, and replies to questions posed in scientific articles.

Enjoy your magazine,

Patricia Langford

Patricia Langford

"Poirieria" is the journal of the Conchology Section of the Auckland Museum Institute (CSAMI), incorporating Auckland Shell Club.

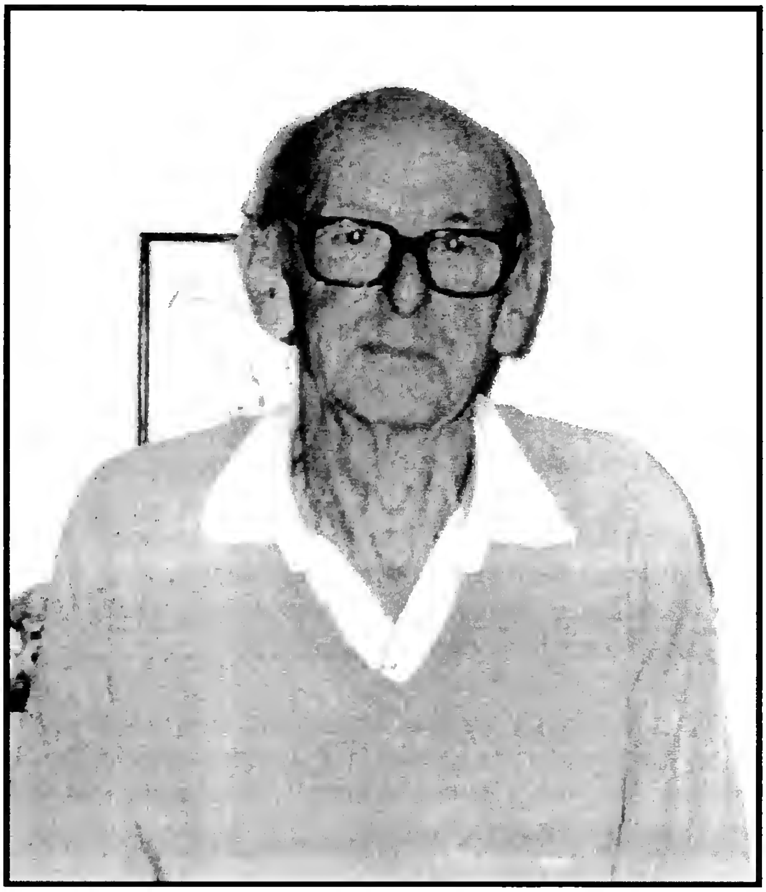
Subscription to "Poirieria" is by membership of the CSAMI. All correspondence regarding membership, change of address, distribution queries, back issues, etc should be addressed to : The Secretary, 42 Black Teal Close, Albany, North Shore City, Auckland, New Zealand.

We welcome contributions on suitable topics forwarded to the above address or to : The Editor, 1 Celina Place, Browns Bay, North Shore City 0630, Auckland, New Zealand.

Views expressed in the "Poirieria" are those of contributors and may not necessarily reflect the opinion of the CSAMI.

OBITUARY—NORMAN W GARDNER

Margaret S Morley, Noel Gardner and Bruce W Hayward



Norm Gardner : 16 September 1920—31 July 2006

Norm Gardner joined the Conchology Section in 1947 and was a stalwart member until a few years of ill-heath just before his death in 2006. Both Norm and his wife, Noel, were made Life Members in the late 1950's.

Norm and Noel shared a common interest in shells. She had joined the Section when 12 years old in 1933. They met at the club and two years after Norm became a member they were married in 1949. From then on most of their spare time was devoted to shells, the Conchology Section and to helping Baden Powell at the Auckland Museum.

It is hard to believe today, but Baden didn't drive, so Norm used to act as his chauffeur. Norm and Noel became volunteers at the Auckland Museum, outstaying several curators, and between them they clocked up a mind-boggling 100 years of service. In 2006, their contribution was recognized when they were made Honorary Life Members of the Auckland Museum Institute. Shortly before Norm died the Marine Department of the Auckland Museum held a morning tea in their honour.

Their shell collection was gradually built up over many years. They travelled all over New Zealand on camping trips spending many happy hours looking for shells both on the beach and in the bush. Norm's interest included microscopic marine shells. Members were made welcome in his basement study at their Birkenhead house where he was always willing to identify specimens or explain the intricacies of taxonomy. Noel says, "I wouldn't dare dust in there!" Norm's identifications had not only the scientific name, but the family and authority which were helpful in learning. This was before Baden Powell's classic book published in 1979, when the main text book was Suter's Manual and Plates. Norm was popular at the end of conchology meetings when help was needed with identifications, having been brought up on Suter he could readily track synonymies.

From 1952 to 1981 Norm and Noel were Conchology Section Co-Editors, initially of the two series of Bulletins, and Subsequently of Poirieria which was established in 1962. In nearly all Poirieria journals there were articles by Norm describing various families, documenting observations, including drawings, and bringing us up to date with names. Norm's articles were valuable in bridging the gap between Suter and later scientific papers.

Norman was continuously on the committee for many years and appointed President from 1954 to 1956 and again in 1977, however he was not happy in the limelight, much preferring to be active behind the scenes. In the Bulletins it is recorded that he held the post of Librarian for some years. He had a dry sense of humour and his delightful soft chuckle was frequently heard. More recently he was elected Vice Patron.

Norm was a cabinet maker and used this skill in 1972 to make a large wooden trophy of a volute awarded to writers of the best article in Poirieria. Many hours were also spent making smaller versions for winners to keep. His wide knowledge of molluscs made him a competent judge, both for this award and for Shell Shows. Norm played a major role in organizing the 1978 Shell Show.

In their own right the Gardners became skilled malacologists and undertook research particularly on land snails, initially in New Zealand, but later in the Pacific Islands (especially in the Solomon's where Norm collected large land snails during visits over several years). This knowledge was used to identify and catalogue land snails in the Auckland Museum Collections.

Norm and Noel organized numerous field trips for the Conchology Section. On one land snail trip to Waipoua in 1980, we were driving in convoy when Norm stopped at Helensville to take a break. He immediately set off to access the tidal estuary via a decrepit landing platform. As a new chum (MM) this didn't seem a likely collecting place. However we were soon getting up to our knees in soft mud and inspired by Norm's lecture on thousands of *Potamopyrgus estuarinus*! The car owners however were not so pleased! During a land snail visit to Fiordland with Jim Goulstone they were so badly attacked by sand flies that they wore plastic bags over their hands!

Shells have been named in his honour. *Potamopyrgus gardneri* was discovered by Norm and Noel in a swampy stream in Northland, the name now lost under synonymy with *P. creswelli*. *Placostylus ambagiosus gardneri* is a subfossil found in consolidated dunes behind Tom Bowling Bay. A third name may eventuate as a result of Norm's work on the Solomon Islands land snails with Belgium Scientist, Andre Delsaerdt. Norm also described and named some species (Gardner 1977a).

Norm's contributions to both the Conchology Section and Auckland War Memorial Museum have been immense. His quiet, supportive presence and expertise are sadly missed.

Selected Publications

(Many short articles in Poirieria and Papustyla unlisted)

Gardner, NW and Gardner, EN 1949 The native land snails of Rangitoto Island. *Auckland Museum Conchology Club Bullet* 5:7-13

Gardner, NW and Gardner, EN 1951 Some observations on the Fijian snail *Placostylus* (Callintocharis) *gracile* (Brod). *Auckland Museum Conchology Club Bulletin* 9:9-11

Gardner, NW 1966 *Iredalina*, our golden volute. *Poirieria* 3(2):22-23

Gardner, NW 1966 High tidal molluscs of Rangitoto Island. *Poirieria* 3(4/5):59-60

Gardner, NW 1970 A new genus and species of freshwater snail (Hydrobiidae) from northern New Zealand. *Transactions of the Royal Society of New Zealand. Biological Sciences* 12:181-184

Gardner, NW 1971 New Zealand recent Fissurellidae. *Poirieria* 5(6):107-116

Gardner, NW 1973 Mussels—Mytilidae in New Zealand. *Poirieria* 7(2):33-38

Gardner, NW 1975 Our Wentletraps. *Poirieria* 8(2):26-30

Gardner, NW 1976 Native landsnails of Resolution Island, Fiordland. *Auckland Museum Conchology Section Bulletin* 1(new series):24-27

Gardner, NW 1977a A new Flammulinid land snail from the northern block of Northland (Endodontidae: Phenacohelicinae). *Bulletin 2* (new series):8-10

Gardner, NW 1977b Collecting snails in the Lake Hauroko area of southern Fiordland, New Zealand. *Poirieria* 9:35-41.

Ramsay, GW, Gardner, NW 1977 Endangered and rare New Zealand invertebrate species. *The Weta* 1 (1):3-5

Gardner, NW 1978 Molluscs from the channels of Parengarenga. *Poirieria* 9(4):75-77

Gardner, NW 1978 *Lepsiella scobina* (Quoy & Gaimard) - our oyster borer. *Poirieria* 9(5):86-88

Gardner, NW 1979 *Pseudovermis hancocki* Challis. *Poirieria* 10(4):66

Gardner, NW 1981 *Trivirostra oryza* (Lamarck) - another new record. *Poirieria* 10:77

Gardner, NW 1982 Some shells of South Santo—Vanuatu. *Poirieria* 12(1):7-9

Gardner, NW 1989 Tree snails from New Zealand. *Papustyla* 11:3

Gardner, NW 1990 Cape Maria landsnails—Northland, New Zealand. *Papustyla* 3:4-5

NAME CHANGES FOR SOME COMMON INTERTIDAL SNAILS

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Genetic work on the evolutionary relationships of many animal groups often throws up unexpected results. Since scientific classification is meant to reflect evolutionary relationships, these results sometimes require changes in nomenclature. Indeed, as a consequence of work on the Trochidae, Turbinidae, Littorinidae and Neritidae, the classification and names of several of our better known intertidal gastropods have recently been changed. In addition, this work has revealed a new species, morphologically very similar to existing species, but genetically distinct. In this note, I summarize some of these changes, especially as they affect New Zealand species.

Trochidae

In our intertidal zone, members of the genus *Diloma* Philippi, 1845 are often ecologically dominant. Donald et al. (2005) used genetic tools to elucidate the evolutionary tree (or "phylogeny") of our species and related taxa from Australia, South Africa, the Indo-Pacific and Europe. Their tree is shown in Figure 1, and shows several distinct clusters of species, which these authors interpreted as genera. Most importantly for New Zealand conchologists, it is clear that the genus *Melagraphia* Gray, 1847, which has long been used for *M. aethiops* (Gmelin, 1791), is a synonym of *Diloma* and so what is possibly our best-known intertidal trochid should be known as *Diloma aethiops* (Gmelin, 1791).

The southern Australian species, previously all placed in *Austrocochlea* Fischer, 1885, in fact fall into three separate genera. *Austrocochlea* is retained for *A. brevis* Parsons & Ward, 1994, *A constricta* (Lamarck, 1822), *A diminuta* (Hedley, 1912), *A porcata* (A. Adams, 1853), *A. rudis* (Gray, 1826) and, possibly, *A. zeus* Fischer, 1874 (although this species was not analyzed genetically). *Chlorodiloma* Pilsbry, 1889 is recommended for *C. adelaidae* (Philippi, 1849), *C. crinita* (Philippi, 1849), *C. odontis* (Wood, 1828) and, probably, *C. millilineata* (Bonnet, 1864) (which, again, was not examined). The final temperate species should be known as *Diloma concamerata* (Wood, 1828).

The South African species all group together in the genus *Oxystele* Phlippi, 1847. This group has sometimes been treated as a subgenus of *Diloma* but it is worthy of generic rank. Similarly, the European *Osilinus* Philippi, 1847 is also a good genus.

Only four of the nine currently recognized species of the tropical genus *Monodonta* Lamarck, 1799 were included in the study. Intriguingly, different populations of what appears, on shell characters, to be *M. labio* (Linné, 1758) are genetically distinct, which suggests that two (or more) species are lurking under this name.

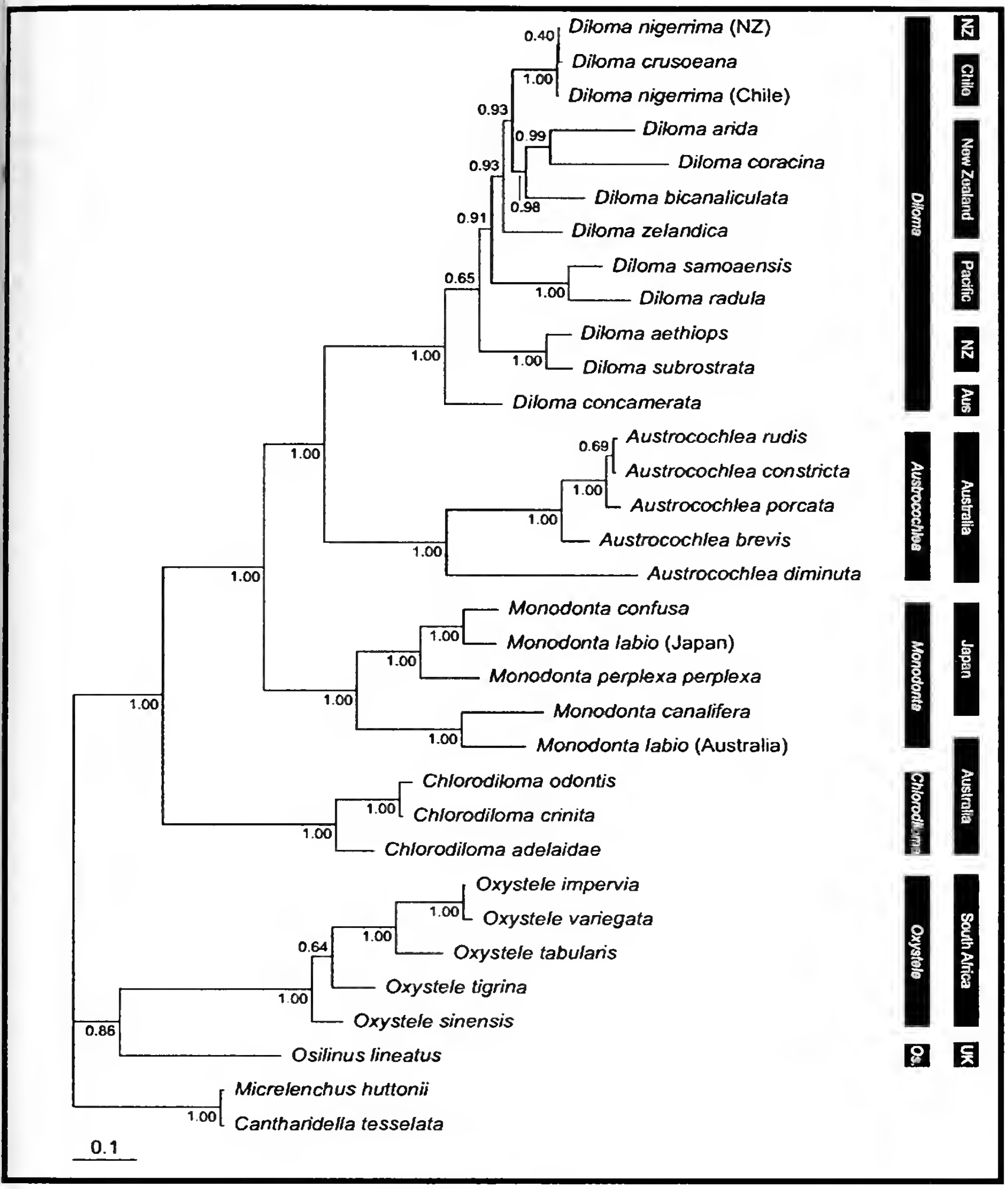

Figure 1. Evolutionary tree of the Monodontinae, from Donald *et al.* (2005), with permission of Elsevier Inc. Numbers on the branches are a measure of support ("Bayseian posterior probabilities"): branches with values < 0.9 should be regarded with caution.

The evolutionary tree (or "phylogeny") of the Trochidae and its relatives is not yet complete. But already it is clear that the relationships among the different genera are different from that implied by the morphologically based classification of Hickman & McLean (1990). The work by Williams *et al.* (2008) examined the relationships of many genera traditionally ascribed to the Trochidae and Turbinidae, and resulted in several changes to higher taxonomy. Several groups were raised from subfamilies to the family level: Angariidae, Calliostomatidae, Chilodontidae (= Eucyclinae), Colloniidae, Liotiidae and Solariellidae. The Margaritinae was transferred from the Trochidae to the Turbinidae. Within the Trochidae, Williams *et al.* (2008) resurrected the Cantharidinae, with New Zealand representatives *Cantharidella* Pilsbry, 1889, *Cantharidus* Montfort, 1810 and *Micrelenchus* Finlay, 1926, and the Monodontinae, which contains all the genera studied by Donald et al. (2005), including *Diloma*.

Finally, while conducting a study of the biological communities found in the holdfasts of the bull kelp, *Durvillaea*, Spencer *et al.* (2009), discovered a new species of *Diloma*, the first new species recognized from New Zealand in more than 150 years. Superficially like *D. arida* (Finlay, 1926), the new species, *D. durvillaea* Spencer, Marshall & Waters, 2009, differs in having stronger spiral ribs on the body whorl and an almost complete absence of the sparse pale yellow spotting, which is characteristic of many *D. arida* individuals (see Figure 2). *D. durvillaea* occurs from Banks Peninsula south to Otago and the Auckland Islands, but, strangely, is yet to be recorded from Stewart Island. It is found only on exposed shores at the low-tide level, always on bull kelp, in its holdfasts and on thongs and blades. *D. arida* occurs on and under rocks, from sheltered harbour shores to exposed shores, but at the mid-tide level.

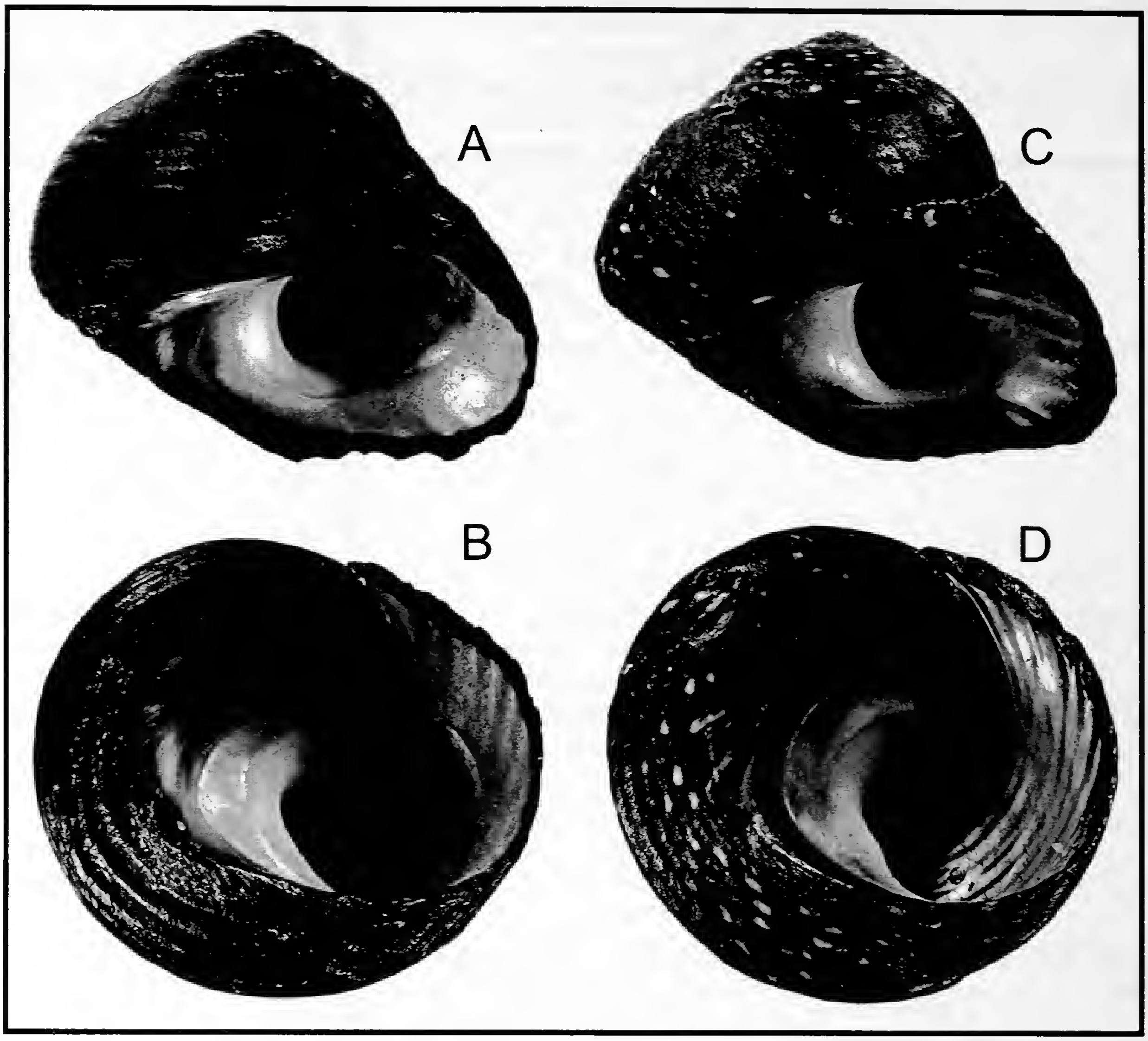

Figure 2. A, B: *Diloma durvillaea* Spencer, Marshall & Waters, 2009; **C, D**: *D. arida* (Finlay, 1926). Reproduced from Spencer *et al.* (2009) with permission of CSIRO Publishing.

Turbinidae

Perhaps the greatest surprise in the paper by Williams *et al.* (2008) was the finding that the tropical genus *Tectus* Montfort, 1810 was not a trochid, in spite of its close conchological resemblance to *Trochus* Linné, 1758, but a turbinid. The most important change for New Zealand workers was the return of our Cat's Eye Turban to the genus *Lunella* Röding, 1798, as *L. smaragdus* (Gmelin, 1791).

Neritidae

The Australian and New Zealand populations of the common intertidal black nerite have long been considered to consist of a single species, most recently under the name *Nerita atramentosa* Reeve, 1855. When revising his New Zealand checklist, however, Powell (1977) continued to use the name *N. melanotragus* E.A. Smith, 1884, but in a rare change, reduced the distinction to the level of a subspecies, *Nerita atramentosa melanotragus*, in his monograph of the New Zealand fauna (Powell, 1979).

In their study of Australasian populations, Waters *et al.* (2005) unexpectedly found two genetically distinct species subsumed under what had previously been considered to be just *N. atramentosa*. One species, primarily western, occurred from Western Australia, eastward across the Great Australian Bight, to New South Wales, including Tasmania; the other, eastern, species ranged from South Australia, Victoria and Tasmania, northward to Queensland, as well as New Zealand, Lord Howe Island and Norfolk Island and the Kermadec Islands. Subsequent morphological inspection found that these two species can be easily separated, provided you looked at the operculum. The western species has a black operculum; the eastern species has an orange-tan operculum with two arching black stripes.

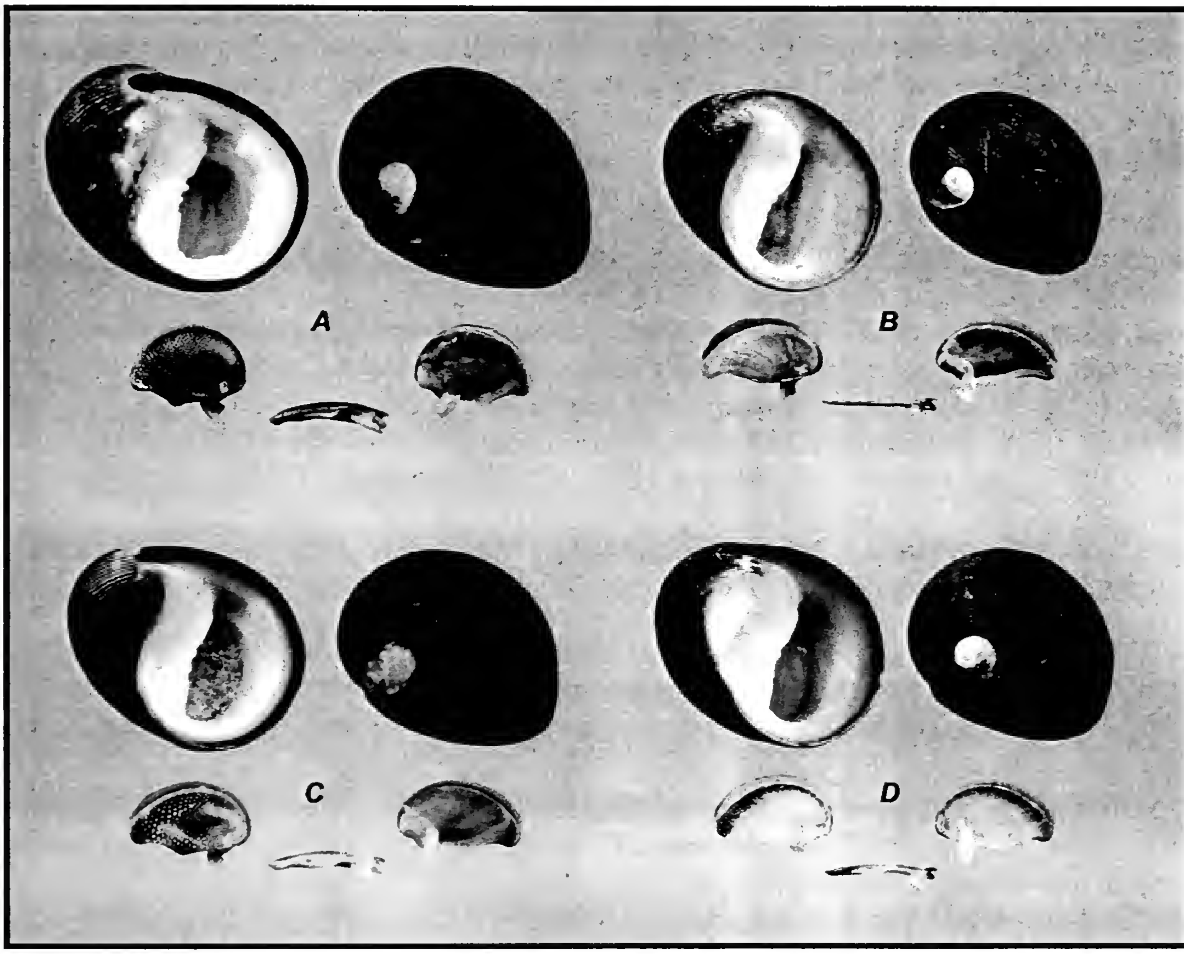

Figure 3. Shells and opercula of species of *Nerita* (*Lisanerita*). **A**: *N.* (*L.*) *atramentosa* Reeve, 1855; **B**: *N.* (*L.*) *lirellata* Rehder, 1980; **C**: *N.* (*L.*) *melanotragus* E.A. Smith, 1884; **D:** *N.* (*L.*) *morio* (G.B. Sowerby I, 1833). Photograph courtesy of Tom Eichhorst, reproduced from Spencer *et al.* (2007), with permission from CSIRO Publishing.

Spencer *et al.* (2007) showed that these two species should be known as *N. atramentosa* and *N. melanotragus*, respectively. Conchological differences were apparent, as well, with *N. atramentosa* having much stronger columellar teeth. But surprisingly, these two species were not even each other's closest relatives: *N. morio* (G.B. Sowerby I) from Easter Island was very closely related to *N. melanotragus*. Again, it has a distinct operculum, creamy yellow, with a single arched black stripe. All three species, as well as another from Easter Island, *N. lirellata* Rehder, 1980, should be placed in the subgenus *Lisanerita* Krijnen, 2002. These four species are illustrated in Figure 3.

Littorinidae

Genetic work on this important worldwide family by Williams *et al.* (2003) has shown that there is a remarkable degree of convergence in shell form and colouration, which has significantly misled our previous classifications. Reid & Williams (2004) showed that the two common intertidal periwinkle species endemic to New Zealand should be placed in the genus *Austrolittorina* Rosewater, 1970. The genetic results revealed that *A. cincta* (Quoy & Gaimard, 1833) and *A. antipodum* (Philippi, 1847) are, in fact, each other's closest relatives, in spite of the apparent similarity of the latter species with the Australian *A. unifasciata* (Philippi, 1847). Reid (2007) placed two further species found, in New Zealand, only at the Kermadecs in the subgenus *Granulilittorina* Habe & Kosuge, 1966 of the genus *Echinolittorina* Habe, 1956: *E.* (*G.*) *cinerea* (Pease, 1869) and the rarer *E.* (*G.*) *feejeensis* (Reeve, 1855). Confusingly, some previous workers have used the latter name for the former species.

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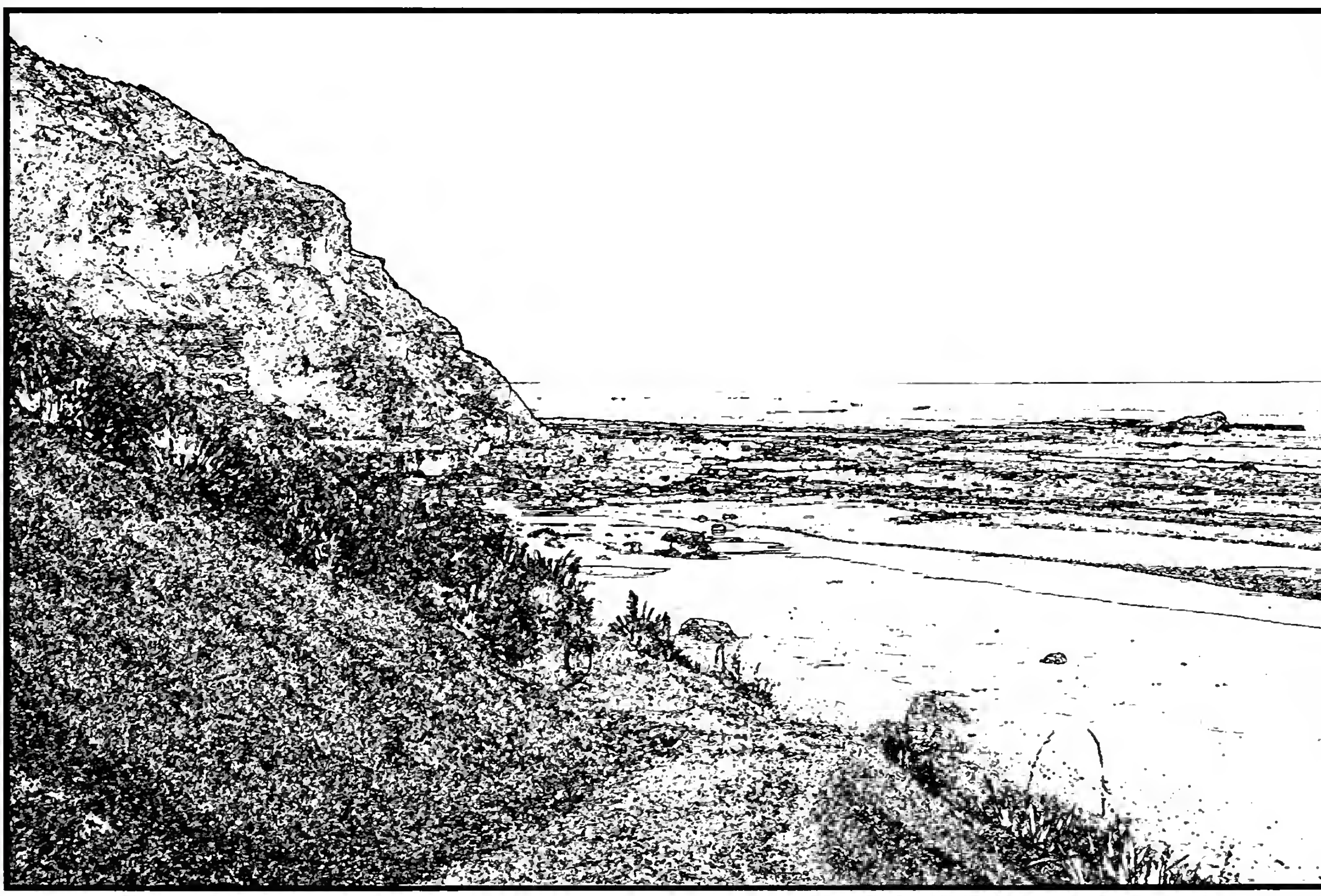
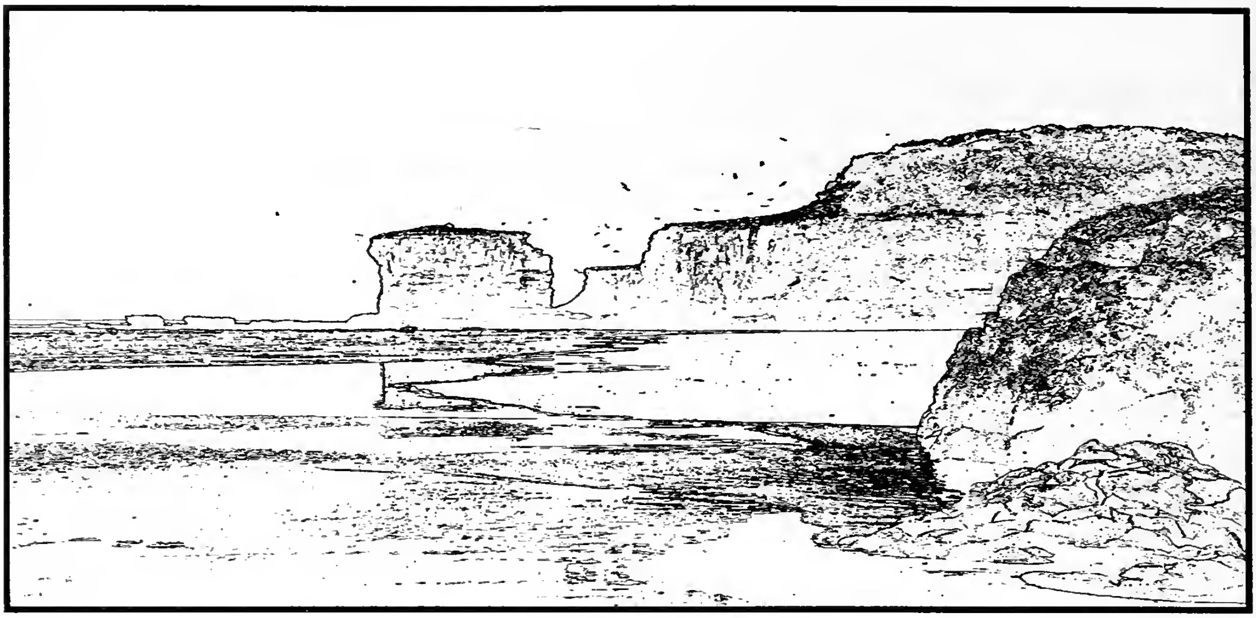
MOTUTARA: THE WILD WEST COAST

Michael K Eagle

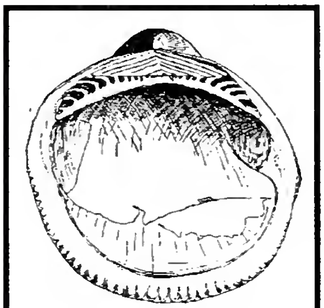
Early morning sun begins to warm the volcaniclastic rock above and below the old Maukatia (Maori Bay) andesite aggregate quarry, now part of an Auckland Regional Park. Soft light strikes the grainy texture in a display of sparkling crystals, high-lighting variations of grey and charcoal black that, like the fossils embedded in the stone, come from a seascape formed about 17.4 million years ago in a subtropical ocean. Shallow water molluscs moved down slope by gravity flow lahars into a prehistoric deep water, submarine, benthic biotope are remnants of coral boulder banks and rocky substrates on the flanks of partially submerged volcanoes, then existing to the west and north. Shark teeth and a rare cavoliniid also indicate a



nektic biodiversity of a bygone time. Although we acknowledge these fossils as marine fauna similar to those in today's oceans, their presence in the cliff face feels as distant as an ancient language. What seems even more unusual is the manner in which they have been preserved with the almost homogenous beds of the various formations. Locked in darkness for millennia, now exhumed and exposed by abrasive erosion, their steinkerns (or internal casts), re-crystallised shells, and specimens with only a few weathered, weakly calcium carbonate tests left, can be elusive to the eye. There are few places in the world where fossils of any description are remaindered in a volcanic deposition as they are here. It is a unique place, a past seabed merging with another, bounded above by submarine volcanic intrusions in the form of tall pillow-lavas and large, wildly radiating andesite dykes. Given prehistoric turbulence, both in volcanism and water column turbidity currents, it is all the more surprising delicate gastropods and thin-shelled bivalves survive, some intact (bivalves sometimes conjoined).



University of Auckland geology Professor Jack Bartrum and Auckland War Museum conchologist A.W.B. Powell collected recent molluscs and fossils from Motutara and recorded faunal lists (e.g. Powell 1935). However, it was left to geologist and marine biologist B.W. Hayward to later map parts of the coastline and describe new fossil molluscan species as part of a PhD, later for the production of a Geological Society booklet (Hayward 1980) and New Zealand Geological Survey map still used today (Hayward 1983).



Tucetona aucklandica (Powell, 1938)

Bartrum and Powell Bays were named for Jack Bartrum and Baden Powell by Bruce Hayward in honour of their pioneering malacological and paleontological achievements. The small but highly distinctive Early Miocene (Altonian) bathyal molluscan faunaule recorded from Motutara includes bivalves: *Saccella motutaraensis*, *Tucetona aucklandica*, *Propeamussium zitteli*, *Lucinoma taylori*, *Anodontia waharoaensis*, *Euciroa maoriana*; *Thyasira bartrumi*, *Elliptotellina protensa*, *Crenostrea gittosina*; gastropods: *Clifdenia turneri inflata*, *Calliotropis motutaraensis*, *Cirsochilus priscus*, *Hipponix centrifugalis*, *Taniella motutaraensis*, *Echinophoria toreuma*, *Falsicolus gemmatus*, *Bathytoma mitchesoni*, "*Lornia*" *marwicki*, "*Conus*" *amoricus*; the thecosomatid *Vaginella depressa*; the scaphopod '*Dentallium*' *nanum*, and Ranellidae gen. & sp. indet. (see: Beu & Maxwell 1990). In addition to the many molluscs recorded from Motutara are fossil: annelid tubes, solitary and colonial corals, teleost and chondricthyan elements, carbonaceous or siliceous wood, leaf impressions, echinoids, sea-stars, and many types of ichnofossils (see: Eagle 1993, 1999).

Exposed at opportune places along the Motutara coast are extensive Maori Middens containing mussel (*Perna canaliculus*), toheroa (*Paphies ventricosa*), and various gastropods including *Dicathais orbita*. Middens are usually marked by slope collapse or storm incursion cut into the land. These piles of molluscs attest to past marine productivity of the area and a valuable food resource available to the population at one time or another by the extensive settlement of Maori Tangata Whenua groups such as Te Kawerau á Maki and Ngāti Te Kahupara. Hard-won marine mollusc shells litter surrounding hinterland of the Pa sites of Tirokahua Point, Otakimiro Point, and Oneonenui á Kainga (near Okiritoto Falls), all established up-hill from the shore for security and fertile gardening on prominent headlands adjacent to off-shore reefs and the Tasman Sea. Various mollusca live attached to rock on boulder beaches, wave-cut sandstone platforms, adjacent cliffs, and caves at Motutara. Common intertidal fauna include the chitons: *Eudoxochiton nobilis*, *Plaxiphora caelata*, *Plaxiphora obtecta*; limpets: *Tetraclitella depressa*, *Gardinia conica*, *Notoacmea parviconoidea* form *nigrostella*, *Notoacmea pileopsis*, *Siphonaria australis*; bivalves: *Xenostrobus pulex*, *Perna canaliculus*, *Haliotis iris*; gastropods: *Marinula filholi*, *Austrolittorina antipoda*, *A. cincta*, *Paratrophon cheesemani*, *Lepsiella scobina*, and *Dicathais orbita* (see: Powell 1979; Morton 2004).

In the here and now of a wonderful, clear, south-westerly aired morning, the drab greyness of the substrate that the undersea, under-lava sands and ash became still has life in it. Scoracious brown and black inclusions in the rock absorb the heat, drying out the surface salt from spray and spume mists coating them, slowly but surely frittering the hinterland rock. Little Blue Penguin burrows and White Fronted Terns nest beneath Otakimiro Point, adjacent to the several sea-caves and a fisherman's platform. This is not simply a visual environment; it is the natural basis for the ecology of the place, and the stone (lava, ash, and sands) provides the rugged spine of the coastal landscape. This is seen from above by a few young, gliding, Australasian gannets that did not migrate, the occasional late red flower of a creeping succulent, new shoots hardening on Pohutakawas to brave the tumultuous seasons, cries of Black-backed gulls, and always the wavering flax. A voluntary moratorium on taking has allowed mussels, kina, and blackfoot paua to return, much to the delight of the predatory orange and red *Stichaster australis* sea-stars. Linked together, all these things (and many more) make ecological sense, but there is something else in the play of light on the stone: it is surely the stage where dramas of life pass, past and present, but the whole is so ephemeral that it escapes every attempt to describe it adequately in words or images. The relentless crashing of surf upon sand and boulder beaches, wave-cut platforms to collect or fish from, and the ragged, rising cliffs of volcaniclastic rock and lava that is Motutara belongs to a geological time forever beyond our experience.

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EVALEA SABULOSA (SUTER,1908) (*GASTROPODA; PYRAMIDELLIDAE*)

Margaret S Morley

These notes on the micromollusc *Evalea sabulosa* record an extension of range from Fosterian (F) and Antipodean (An) provinces to Aupourian (A), Cookian (C), Forsterian (F) and Moriorian (M) and identify one likely host, the oyster species, *Ostrea stentina*

E. sabulosa is in the parasitic family Pyramidellidae. It has a maximum height of 4 mm (Powell 1979). Distinctive features of this species are a sinistral protoconch, a plait set well within the aperture, spiral grooves and dense axial threads (Fig.1).

The prefix AK indicates registered numbers in the Marine collections of the Auckland War Memorial Museum.

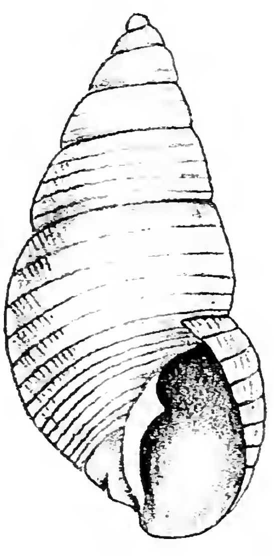

Figure 1. *Evalea sabulosa.* Height 3 mm; Location Bucklands Beach, Tamaki Estuary, in dead oyster *Ostrea stentina.*

Previous recorded range

E. sabulosa is already recorded from Eastern Otago to the Snares, Auckland and Campbell Islands (Powell 1979). The type was dredged off the Bounty Islands in 90 m (Powell 1979, Spencer et al. 2002). It is also recorded from a depth of 310 m off the Bounty Islands (AK118814). This range within F and An provinces is supported by lots in the Auckland Museum marine collections from Dunedin (AK118810); off Otago Heads (AK118816); Dusky Sound, Fiordland (AK118807); Snares Islands (AK118815); Carnley Harbour, Auckland Island, depth 10 m (AK130702) and Campbell Island (AK118812).

Extension of Range

Specimens of *E. sabulosa* in the author's collection are from off Oamaru, depth 102 m; Waipapa, Southland; intertidal at Jackson Bay, west coast South Island; Princes Bay, Wellington; Tolaga Bay, East Cape, North Island; Bucklands Beach, Tamaki Estuary; and in shell sand, Tryphena, Great Barrier Island. Several specimens found in shell sand from Mahia Peninsula, east coast of the North Island (AK118808), and one alive at Kennedy Point, Waiheke Island, also extend the range.

Two specimens found in shell sand at Waitangi, Chatham Islands are in the M province (AK118809).

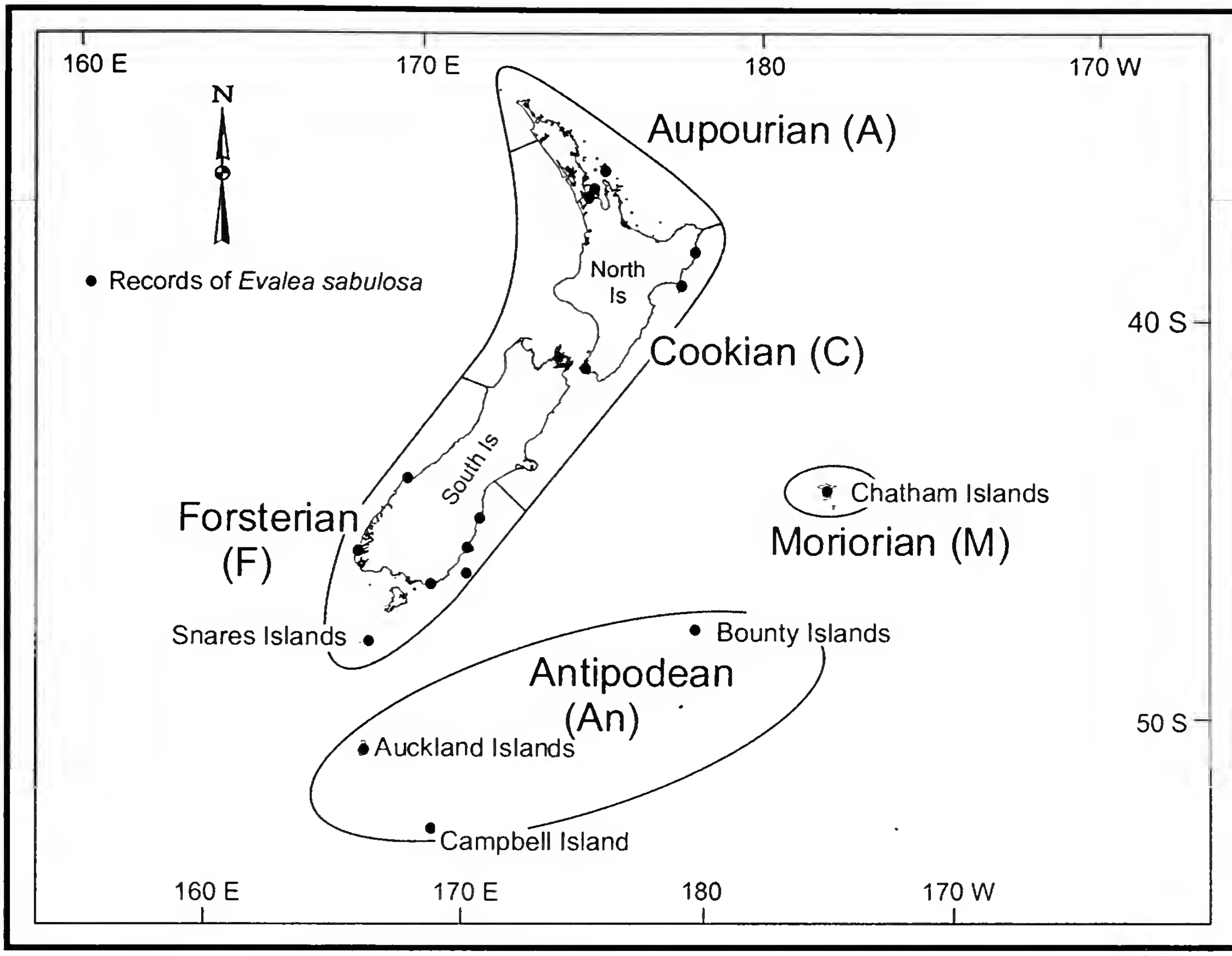

Figure 2. Map of revised range of *Evalea sabulosa.*

These Chatham Island and North Island specimens now extend the recorded range from F and An provinces to the whole of New Zealand, except for the Kermadecs (Fig. 2).

Host species

Pyramidellids do not have a radula but an oral sucker and a buccal stylet that pierces the body of their host and a sort of buccal pump extracts the victim's body juices. There are many world-wide species, most favour a particular organism as host, which may be a polychaete worm, an echinoderm, a coelenterate, or a bivalve mollusc (Powell 1979).

A dead specimen, in good condition, of *Evalea sabulosa* (author's collection 7263) was found inside a dead oyster *Ostrea stentina* on low tide rocks at Bucklands Beach, Tamaki Estuary, on 10 March 2007. At the same locality on July 7 2008, a mooring block dragged ashore from the channel during a storm, from an approximate depth of 6 m. Clumps of *O. stentina* (author's collection 7401) were growing on the mooring, and a live *E. sabulosa* (AK118820) was sieved from mud around the oysters.

On 29 May 2009 a further clump of *Ostrea stentina* from low tidal rocks was prised apart, washed and the sieved residue examined under the microscope. Four more specimens of *Evalea sabulosa* were found. None of these were inside live oysters. Other fauna attached to the *O. stentina* included the round slipper shell *Sigapatella tenuis,* a leathery slug *Onchidella nigricans,* barnacles *Balanus trigonus* and *Austrominius modestus,* crabs *Petrolisthes elongatus* and *Pilumnus* sp., ascidian *Pyura rugosa,* sponge, bryozoa, a scale worm, marine worms and an anemone.

Thus it appears likely from these records that *E. sabulosa* is parasitic on *O. stentina* but only in northern localities as the range for *O. stentina is* A and C provinces (Spencer et al. 2002). A different host, possibly the southern oyster *Ostrea chilensis*, would be required for specimens from the Forsterian and Moriorian provinces.

On March 12, 2009 a juvenile specimen of *E. sabulosa* was found alive in sandy gravel under low tidal rocks at Kennedy Point, on the south coast of Waiheke Island, Waitemata Harbour, (AK118760). Although *O. stentina* was not seen on this trip, this oyster could have been living below low tide level or around the ferry terminal nearby. It is common on Matiatia wharf piles on the west coast of Waiheke.

Unfortunately, despite searching more *Ostrea stentina* at other locations, no further *E. sabulosa* have been found to date.

Discussion

None of the associated species living around or on the clumps of *O. stentina* at Bucklands Beach were in high numbers so seem unlikely contenders as host for the *Evalea.* Some, e.g. *Pyura,* can be eliminated as too difficult for a microscopic species to access.

Since no oyster species extend to the Subantarctic, the host for *E. sabulosa* in this region has yet to be determined. This raises the question whether there are undescribed species in New Zealand as most parasitic species favour a particular host (Powell 1979). Three species of *Evalea* are listed in Powell (1979), two of these described by Laws in 1941. *E. sabulosa* is the only *Evalea* species to have axial threads (Powell 1979), however in worn specimens these are sometimes partly eroded and difficult to confirm.

When more is known about the living animal and their hosts, a revaluation of *Evalea* species may be necessary.

Acknowledgements

Many thanks to Bruce Hayward for company during field work, creating the map, formatting the article and suggestions for improvements to the text; to Ashwaq Sabaa (Geomarine) for scanning the drawing; and to Heather Smith for company on the May 29 field trip.

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GEODUCK RIDDLE AT OHOPE

Bruce W Hayward, Glenys C Hayward and Margaret S Morley

Margaret, Bruce, Danielle Carter and Hanno Grenfell were on their way back to Auckland after a visit to Mahia with Auckland Geology Club in 2006 when they stopped for lunch in the middle of Ohope Beach. As Margaret was there we had the obligatory short walk along the beach at high tide level. Bruce soon noticed the unusually numerous geoduck shells (*Panopea zelandica*) that were washed up and collected a handful to show Margaret. They all fitted together snugly in his hand and he soon realised they were all left valves. He thought this to be a little odd and 10 minutes later we had collected 32 shells – 30 left valves and only 2 right valves. Alas, it was time to drive on. Margaret placed the shells along the side of her driveway in Pakuranga and every time Bruce visited he was reminded of the riddle of the geoduck from Ohope. Plans to return to Ohope to conduct more extensive counting to test the validity of the initial observation were finally realised in April 2009, when Bruce and Glenys Hayward made a special pilgrimage to count and collect Ohope geoduck shells.

Geoduck

These large shellfish are deep burrowers that live at up to 30 cm deep in firm sand. The natural gape at the posterior end of the shells allows the large conjoined siphons to extend up the vertical burrow towards the sea-floor surface. Most geoduck live in water depths of ~5 m or more in normal marine salinity and somewhat exposed conditions. This may explain why their shells are not washed up in the large numbers that surf clams are on our beaches. Surf clams (e.g. *Dosinia anus, Paphies subtriangulata, Mactra discors, Crassula aequilatera*) live at shallower depth in the sand at 0-10 m water depth and are commonly washed out in storms and thrown up on beaches in recently dead pairs. Geoduck pairs are seldom washed up – they come ashore singly and none were found as a pair during the present Ohope survey. This is because it is much harder for them to be eroded out by storm waves and further for them to be transported to shore. Presumably most of the shells that are washed up were long since dead and eroded out from their considerable depth of burial over a long period, as major sand movement occurs.

Survey Method

The survey method employed in 2009, was for two people to walk along the beach, one in the dry sand above the recent monthly spring high tide level and the other in the damp or recently damp sand lower on the shore. As they walked they examined all exposed shells and collected all *Panopea* shells that were intact or, if broken, comprised more than half of the shell. After every approximately 25 shells had been collected by one person, a count of the left and right valves in this collection was recorded. The distance travelled along the beach was measured so that the number of shells collected per km of beach could be calculated. We did not have time to walk the whole beach, so one area at the west end (A), two in the middle (B, C), and two in the east (D, E) were surveyed (Fig. 1) – a total of 3.5 km (Table 1).

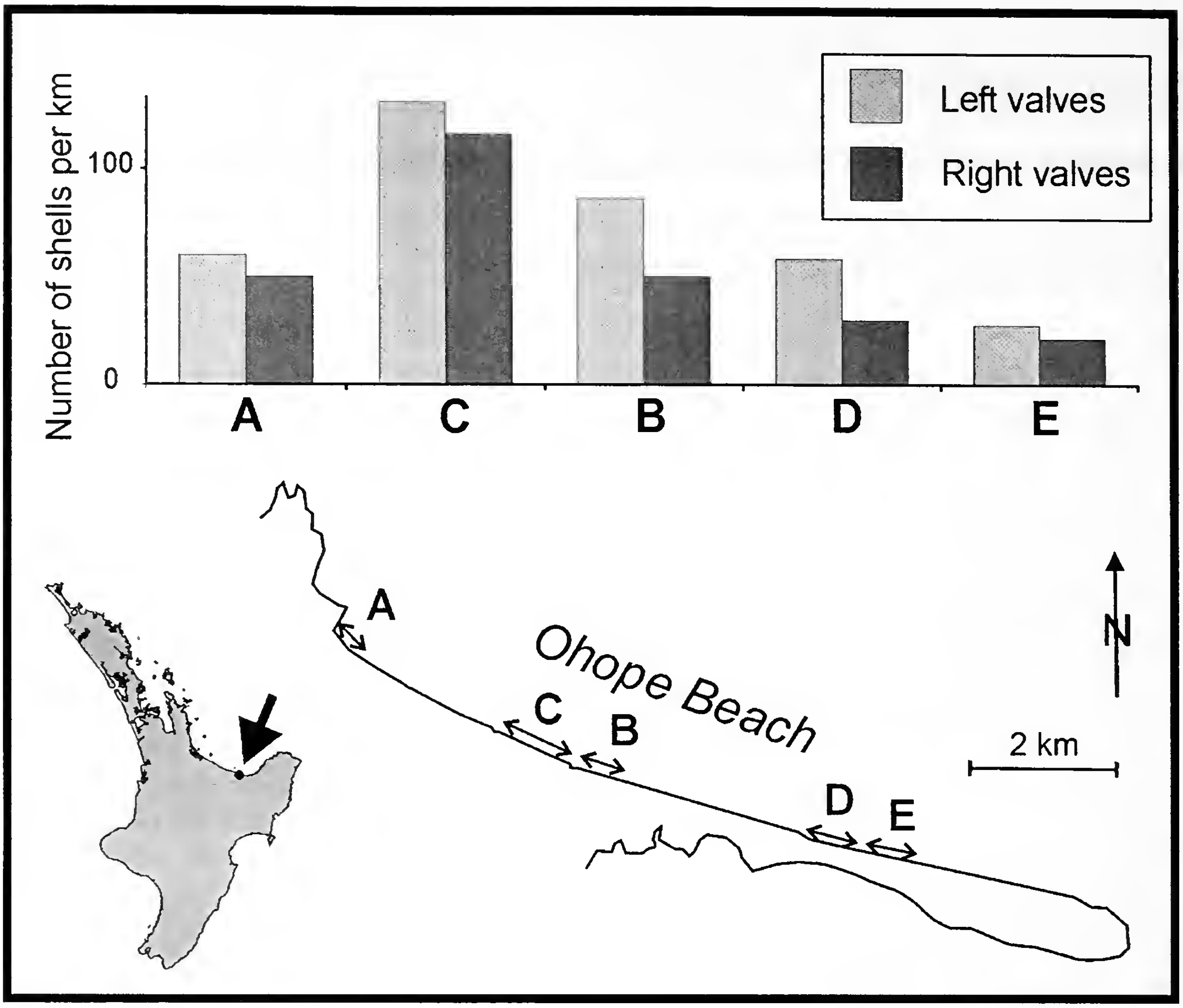

Figure 1. Map showing lengths of beach (areas A-E) surveyed and the number of left and right *Panopea zelandica* valves per km within each surveyed area in April 2009.

Table 1 . Summary of Ohope Beach Panopea Shell survey data (Figure. 1)

Area	Location	Length	Above High Spring Tide		Below High Spring Tide	
			Left Valves	Right Valves	Left Valves	Right Valves
Area A	West End	500m	30	25	Both tidal levels surveyed together	
Area B	Middle	800m	30	29	39	11
Area C	Middle	800m	45	53	60	40
Area D	East End	600m	18	10	17	8
Area E	East End	800m	7	9	15	8

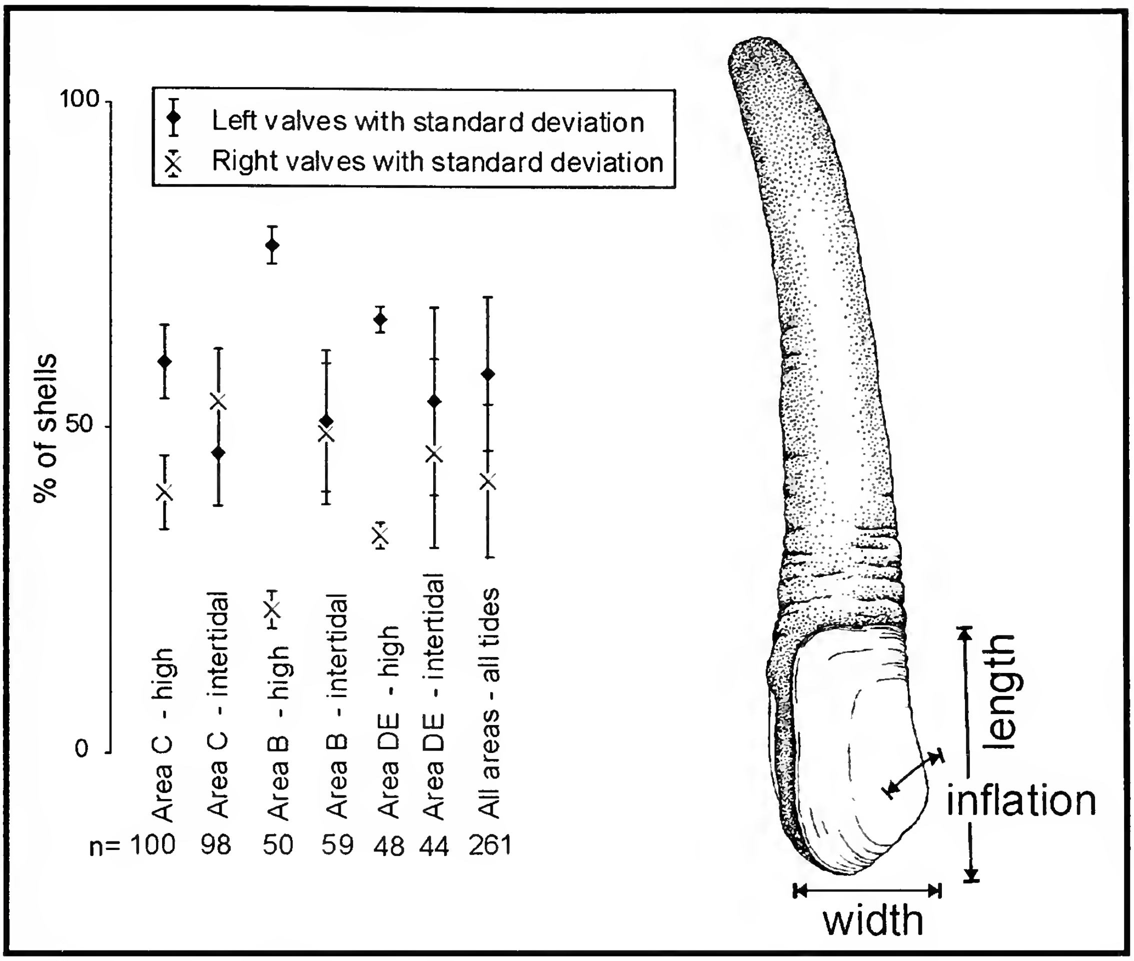

Figure 2. Beach survey results showing the percentage of left and right valves of *Panopea* and standard deviation (based on counts of groups of ~25 shells) in different survey areas (B-E) of beach. Right: In-situ appearance of geoduck with the two elongate valves on the end of long fleshy siphons. Location of measurement directions of length, width and inflation is also shown.

Collected shells were brought back to Auckland in bags divided into areas and into those collected from above spring high tide or lower. Back in the laboratory, only whole shells were measured and weighed. We measured the length, width, inflation and weight of each shell as well as noting whether it was a left or right valve.

Observations, April 2009

1. Abundance of *Panopea zelandica* shells decreases from the middle of the beach (areas B, C; Fig. 1) towards the east (areas D, E), but not of other surf clam shells.

2. Abundance of rare cockle and pipi increase from the middle of the beach towards the east (D, E), towards the entrance to Ohiwa Harbour.

3. Double-valved *Paphies subtriangulata*, *Dosinia anus*, and *Crassula aequilatera* were common among the wash-up. No *Panopea* was found washed up double, although several close together could have been a pair.

4. Children decorating sand castles when given a choice of surf clam shells prefer to use *Dosinia anus*, followed by *Crassula* and then *Paphies*. *Panopea* was not found being used.

5. Some *Panopea* shells had been badly crushed by vehicles, especially above high spring tide level. Those with less than half a shell were disregarded.

6. There was no obvious difference in the number of left and right valves above and below high spring tide level at the west end of Ohope (area A) and they were not counted or measured separately. Differences between these two tidal levels first became apparent during surveying of Area B and after that they were counted separately.

Results

Our survey and measurements addressed the following questions:

1. Are *Panopea zelandica* shells washed-up with uniform distribution along the full 12 km length of Ohope Beach?

   Our beach surveys show that a higher density of *Panopea* shells is washed up towards the centre of Ohope Beach (B, C) than at either end (Fig. 1). Numbers fall away particularly sharply moving east towards the mouth of Ohiwa Harbour, suggesting that perhaps the source of the *Panopea* is somewhere offshore of the middle or west end of Ohope Beach.

2. Are there really more left valves than right valves washed up on Ohope Beach, or on parts of Ohope Beach?

   Fifty-eight percent of the total shells collected were left valves and the remaining 42% were right. Our counting methodology allowed us to show that the difference in numbers of left and right valves was not significant in all areas surveyed below high water spring level (=intertidal), but was significantly different in all three areas counted above high spring tidal level (Fig. 2). In the original 2006 observation, left valves comprise 94% of the above high tide beach shells, whereas in area C in 2009 they comprised 60 +/- 6%, in area B 78 +/-3%, and in area D and E 67+/-2%. So yes, there really were significantly more left valves on the beach above spring high tide, though not as skewed as it was in 2006.

3. Are there differences in the shapes or sizes of left and right valves that might explain their non-uniform distribution?

   Plots of our measurements of length versus width, length versus inflation, and length versus weight show there is no significant difference in the shape or weight of shells between left and right valves (Figs. 3-4). This conclusion is most clearly demonstrated by the trend lines for left and right valves which are almost identical on all three plots. The plot and trend lines of length versus width for shells collected above and below spring high tide level (Fig. 4) also shows no significant difference in shape between these two groups and only slight difference in size, with a few more smaller shells collected from higher on the shore than lower.

4. What do our measurements tell us about the way *Panopea* shells grow?

   There is a linear relationship between length and width and length and inflation in all our *Panopea* shells (Fig. 3). Initially shells grow outwards at a set ratio of length versus these other directions, until apparently reaching their adult length of 90-110 mm. Once this adult size has been reached, the shells continue to deposit shell but do not grow in size. The shells get heavier and thicker through time, with the thickest and oldest shells weighing four times (40 g) that of the unthickened shells (10 g) of young adults of the same length and width (Fig. 4).

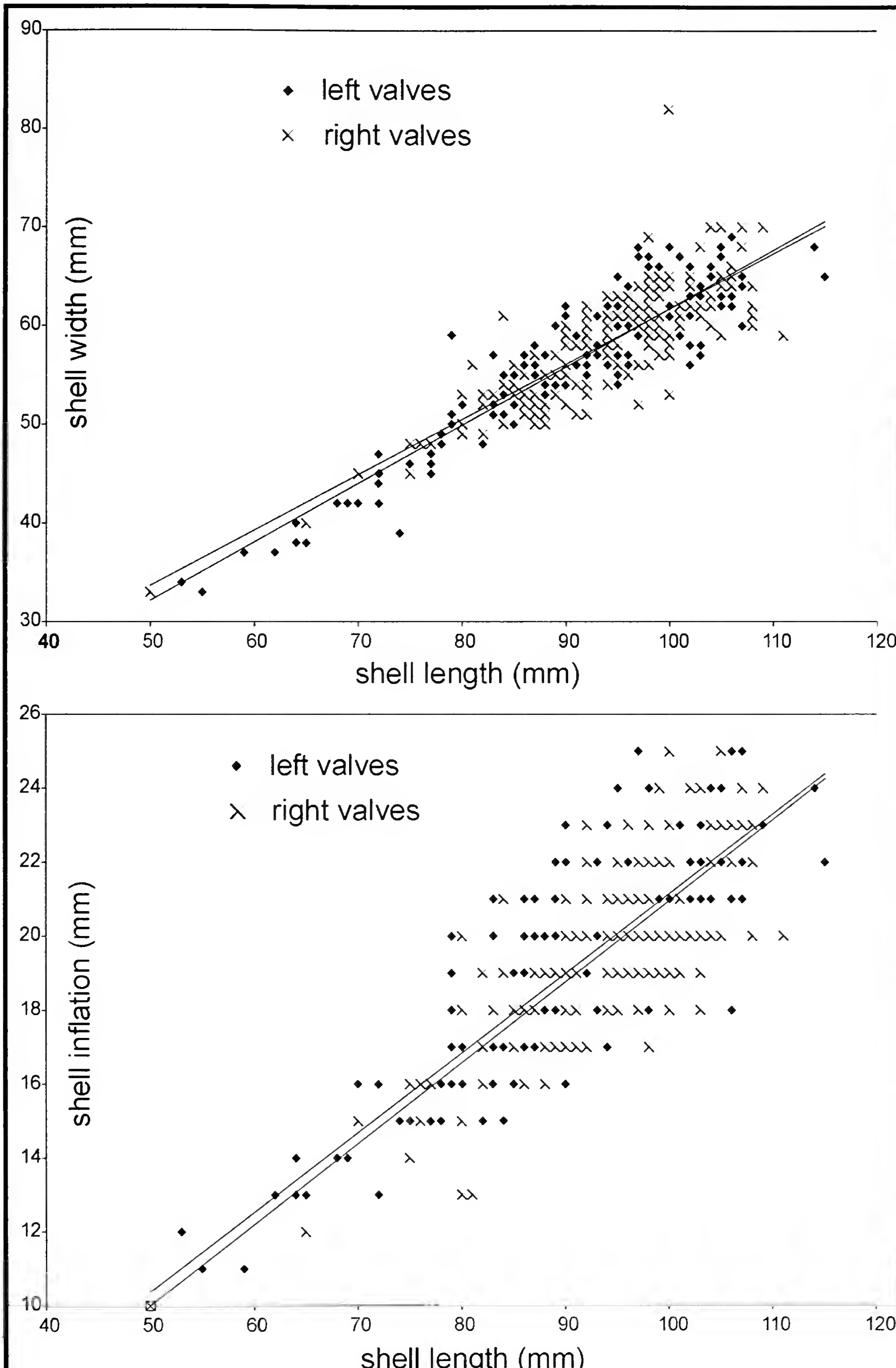

Figure 3. Plots of length versus width, length versus inflation used to investigate potential differences in shape between left and right valves of *Panopea*. Linear trend lines are also shown.

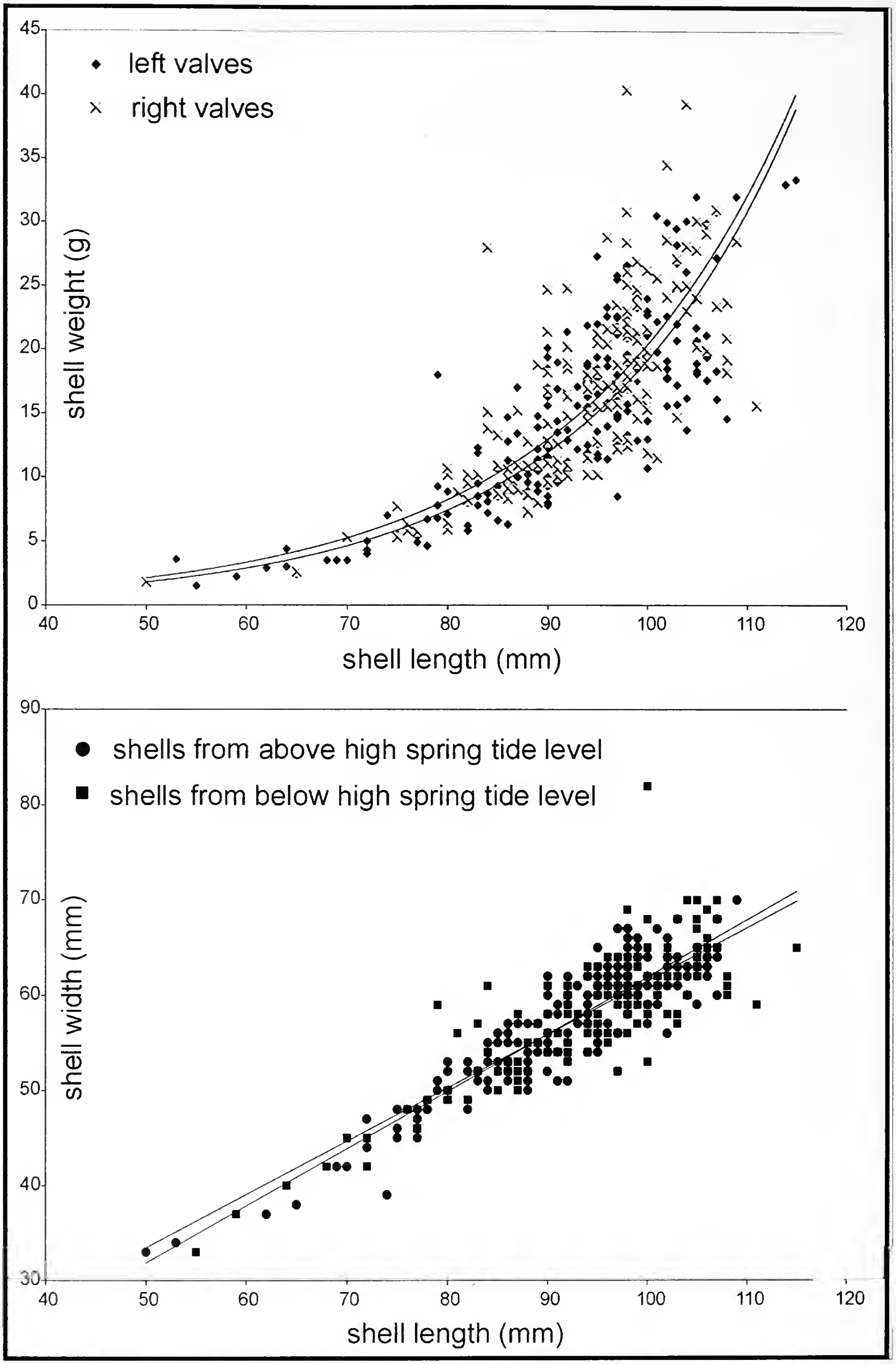

Figure. 4. Top: Plot of length versus weight to investigate potential differences in shape between left and right valves of *Panopea*. Exponential trend lines are also shown. Bottom: Length versus width plot of *Panopea* shells to investigate potential differences in shape between shells collected from above spring high tide level and those from lower on the beach.

5. Do our measurements allow the matching of potential pairs of specimens that have been washed up from single individuals?

Comparisons of the four measurements for each shell allowed us to match no more than 10% of the left and right valves with measurements similar enough to be matching shells from a pair. This is a significant finding as it implies that 90% of the shells washed up or at least not extensively broken nor buried on the beach have no matching left or right valve in our collections. This is surprising, as we would have assumed that both valves would likely have been eroded out at about the same time from their original substrate, and likely would have been transported shorewards and up onto the beach in the same storm event.

6. So what has happened to all the other shells? How old are the *Panopea* shells found high on the beach? In 2009, did we sample the same cohort of washups as in 2006?

Maybe the results in 5 above that show that 90% of shells collected did not have a matching pair, provide a hint that the shells on the beach have accumulated over many years. During that time many have been lost through burial in the beach sand, through collection by people, crushing by vehicles, washed back out to sea or never washed up on the beach at all.

It is highly likely that the shells collected could have washed up on the beach over a long period of time – such as several decades and that many of the shells collected were present on the beach in 2006 when the first collection was made. It would be interesting to do more surveys on the beach in the next few years to see how quickly numbers build up again after our removals of all visible shells. They could wash in from areas of the beach where shells were not collected or wash out of the sand where they were buried and hidden during the 2009 collection survey and thus numbers that appear are not likely to all be from new washups.

7. As there are no apparent differences in the shapes and sizes of left and right valves of *Panopea*, what other hypotheses might explain the observed greater abundance of left valves washed up above high spring tide level?

<u>Some hypotheses</u>

⇒ Left and right valves are a mirror pair of each other and maybe this elongation to the right or left provides sufficient difference for waves, swash or longshore drift to sort shells during spring tidal storms and preferentially wash left valves up high onto the beach. This seems the most likely explanation for our observations and that this was particularly true during a large storm sometime before 2006.

⇒ Right valves are preferentially collected by humans for craft or cultural purposes thereby leaving left valves as the dominant. This would explain our observations, but we have no evidence to suggest there is any truth to it.

Conclusions

Our surveys show conclusively that there were more left valves of *Panopea zelandica* washed up above spring high tide level along much of the length of Ohope Beach. Our measurements show that there are no consistent differences in the shape and size of left and right valves that might explain the survey results. We conclude that the most likely explanation is that left and right valves may behave differently in the swash zone and go in different directions as a result of their mirrored asymmetry with left valves being washed further up the shore, particularly during a major storm prior to 2006. Our results also suggest that the shells on the beach have been accumulating there for many years, if not decades, as no more than 10% have a matching left or right valve present in the collection.

Acknowledgments

We thank Danielle Carter and Hanno Grenfell for finding some of the original geoduck shells in 2006.

MASS MATING OF THE MUD SNAIL, *AMPHIBOLA CRENATA*

Bruce W Hayward

I've been walking New Zealand's intertidal mudflats for many years but never had I come across the mass mating event I encountered in West Haven Inlet, North West Nelson, in December last year. I was there with colleagues Hugh Grenfell and Brigida Figueira studying foraminifera in a sheltered high tidal arm of this large harbour.

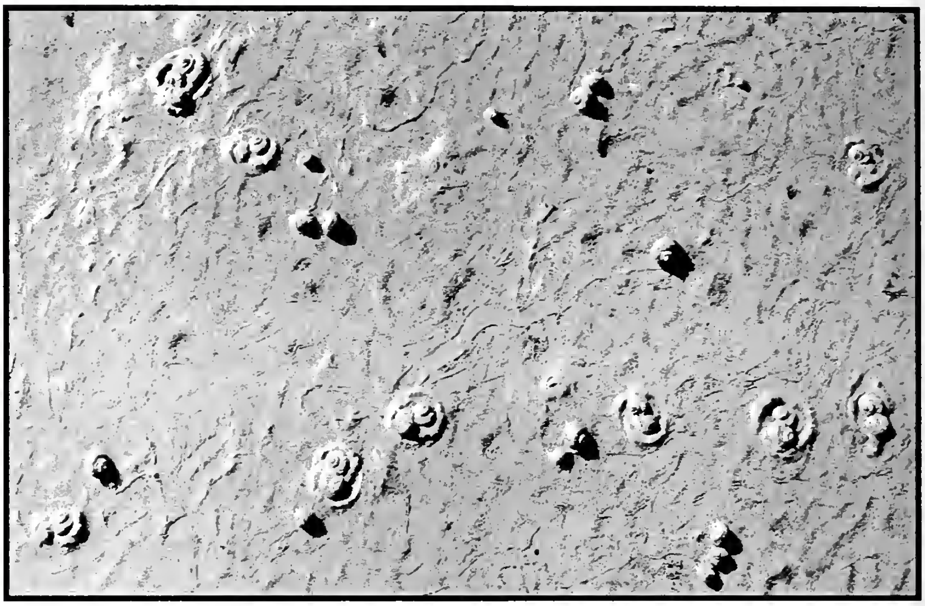

Figure 1. Paired-up mudsnails during mass mating on a low tide at Westhaven Inlet.

Late in the afternoon on a particularly fine and sunny day (2 Dec 2008), the tide was near its spring low tidal maximum and as I walked across the slightly muddy sand flat I noticed that almost all the mud snails (*Amphibola crenata*) were grouped together in pairs. Mudsnails are hermaphrodites but come together to mate and exchange their genetic material. Each pair was surrounded by a small raised ridge of sand that grew as the snails seemed to slowly rotate clockwise together in a tight circle. The snails were oriented aperture to aperture. It was noticeable that in many instances the individuals in the pair were of quite different sizes. An occasional threesome was also observed. A quick count indicated that at least 50% of all snails were coupled up. Snails smaller than about 1 cm across were not involved in this activity. Total densities across the sand flat were estimated at 30-80 specimens per square metre.

Figure 2. A pair of mudsnails rotating clockwise during mating.

We returned next day, two low tides later; it was raining gently and all snails were single and no mating was occurring – much as seems to be the case on all other occasions that I have visited the shore. I wonder if mass mating is a usual seasonal or annual event. If so, many mud snails would have similar birthdays and annual cohorts should be able to be recognised in the population. Has anyone else observed this phenomenon in this or other marine molluscs around New Zealand coasts?

CARL LINNAEUS —SWEDISH NATURALIST (1707—1778)

Patricia Langford

Many readers have had similar experiences to mine—an unfamiliar voice on the phone saying "I have a shell that is brown and white and goes round and round, what is it?" or, "I have one of those shells used as a doorstop, do you know its name?". Here is another serious challenge, "what are the trees with pointed green leaves and white flowers?".

All naturalists owe a great deal to the Swedish botanist Carl Linnaeus, and his orderly classifications that introduced the binomial system to the scientific world. This system for naming species is still in use 300 years after his birth. Carl Linnaeus was born in Sweden in 1707, his father Nils Linnaeus was a modest Lutheran minister, amateur botanist and keen gardener. He and his wife decorated their baby son's cradle with wildflowers and gave the young boy pretty flowers to distract him, when bored or restless. He developed a fascination with all the plants he enjoyed collecting, and pestered his father for the names. These names and their associated descriptive information became an integral part of his lifelong scientific interest in nature of all forms. Linnaeus is still regarded as "the father of taxonomy" as he created the Latin binomial classification system we use. Even though he held creationist views all his life, he believed that humankind should discover, count, identify and appreciate all living organisms. Although he was not a committed evolutionist, he did actually place *Homo sapiens* (his name) in a mammalian category including apes and monkeys.

When Linnaeus was 25, he travelled through Lapland (part of the Swedish Kingdom) and enthusiastically collected and studied everything possible, especially all the plants. He then took a medical degree in Holland, but promptly returned to botany, on the pretext of the pharmaceutical importance of plants. He developed an unusual ability to attract influential friends, willing assistants and collectors. Within several years he published eight books, one was his *Systema Naturae*, the original document of modern taxonomy. In this modest volume, he outlined three kingdoms of nature—plants, animals and minerals. Animals were split into six classes : *Quadrupedia, Aves, Amphibia, Pisces, Insecta* and *Vermes*. The last class included most marine life such as starfish, barnacles, sea cucumbers and molluscs. Each order of *Quadrupedia* was divided into general such as *Leo, Ursus, Hippopotamus* and *Homo*.

But plants were obviously his specialty and their classification was more comprehensive and orderly. This was where he developed his sexual system through his recognition of flowers as sexual structures. He sorted plants into 24 classes based on their sexual parts, but he often embarrassed and disturbed people with his comparisons between plants and complex human relationships. His class 8, including *Fuchsia*, which has eight male stamens around a female pistil, is described by Linnaeus as "eight men in the same bridal suite with one woman". Modern botanists (thankfully) now use a different system, but the original classification of Linnaeus, placing in groups and subgroups, gave a sound framework to modern biology.

His botanical system became rapidly accepted throughout Europe and he went on publishing numerous books. His passion for natural systemic order moved taxonomy towards the revelations of Charles Darwin and Alfred Russel Wallace. Regarding nomenclature he wrote: "If you do not know the names of things, the knowledge of them is lost too". Personally, I believe that in these modern times, with so much published literature, the actual collection data is more important than the name, which any expert can give—but of course, we still need names.

Throughout the 1700's, as more and more species were being discovered, the ponderous method of naming them with long chains of adjectives and references, grew unwieldy. Linnaeus then developed the Latin binomial system, which was used for all species, plant and animal. He became a popular teacher and lecturer at Universities and attracted many young followers eager to travel overseas and willing to do all his foreign collecting for him. By the mid 1700's he was the most renowned European naturalist and corresponded with scientists around the world. Daniel Solander collected plants for Linnaeus during the first voyage with James Cook, around the world.

In 1761, Linnaeus was requested by the Swedish Committee for Economics and Commerce to investigate the possibility of growing pearls in lake mussels. Subsequently he produced the first known cultured pearls from molluscs, using the freshwater *Unio pictorum* (Linnaeus 1758). This was known as the "Painter's Mussel" because artists mixed their pigment in the shells. Linaeus drilled a small hole in the mussel shells, live from the lakes and rivers, inserted a grain of stone between the shell and mantle and cultivated pearls which took at least six years to mature fully. Because this discovery was of such economic importance for Sweden, Linnaeus received the noble title of "von" to add to his name.

He ended his days at his country home at Hammarby, which remained in his family for a century, then became a National Museum. The walls of his old bedroom are still papered with numerous pictures of flowers cut from plates or books, able to be viewed by visitors, three hundred years after his auspicious birth.

The Linnaean Shell Collection

This collection is housed in the Linnaean Society rooms in London. Linnaeus' interest in shells began in 1727, his first student year at University, where he attended lectures on molluscs, given by the eminent Professor Stobaeus. In 1731, Linnaeus obtained a great number of shells from other collectors, considerably adding to his own rapidly growing collection. It is now generally recognised that most of his shells have their origins in places never visited by Linnaeus, and this method of collecting shells continued throughout his life. In the mid 1760's he moved his collection to a small stone house on his country estate at Hammarby, near Uppsala. When Linnaeus died, his son Carl, supervised additions to the collection. These included specimens from Joseph Banks, Daniel Solander and the Duchess of Portland.

In 1784, James Edward Smith, the well known botanist, purchased a significant number of the various Linnaean collections and subsequently gave away some specimens. Some of the large shells in the general collection were housed separately and inadvertently sold in 1863. Records from William Swainson, state that the entire collections of shells and insects belonging to Joseph Banks were housed in the Museum of the Linnaean Society. Several late 19th Century Natural History Museum malacologists worked on the Linnaean shells, renaming and relabelling many of them, and arranging the specimens in a different way.

When Linnaeus published the 10th edition of his *Systema Naturae* in 1758, it described more than 700 species of molluscs, later editions added another 130 species, mostly common, wide-spread shells. The taxonomic status of his work has undergone constant revision, until the mid 19th Century when Hanley clarified many anomalies.

Peter Dance, in 1967, completed his extensive recent research on the current Linnaean collection and found considerable evidence of mishandling of shells and their original labels and metal boxes. Many of the early specimens that Linnaeus based his work on, have been lost or sold, and very little is available for present day study.

However, the Zoological Museum of the University of Uppsala, Sweden, houses more than 1,000 lots of Linnaean mollusca, but some of these show discrepancies when compared with those housed in London, and further specimens seem to have been confused or added since the days of Linnaeus. In the 1750's Linnaeus commissioned a Swedish artist to paint 400 gastropods from the Queen's personal Museum. These unpublished paintings currently are housed in the Royal Swedish Academy of Sciences and many of the actual shells used for the paintings survive in the Museum Louisa Ulricae collection in Uppsala.

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Official photograph of Carl Linneaus

Linneaus aged 25 on Lapland expedition

Some of Linnaeus' plant specimens (including this *Scabiosa*) are preserved at the Swedish Museum of Natural History

A STORY WORTH TELLING ... AGAIN AND AGAIN

Neville Coleman
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Most people's idea of a shell is the external skeleton of a mollusk, or something a hermit crab lives in and carries around to protect its soft abdomen. Few have any idea that molluscs (the animal and the shell) are an extremely important group in the web of life in all our oceans and their continued presence supports major commercial industries as a food source.

Molluscs are fed on by other molluscs, worms, crustaceans, echinoderms, fish, birds and marine mammals and even more so by humans Many aquatic creatures are dependent on chitons, univalves, bivalves and cephalopods for their daily sustenance. In the past to the present, divers have searched out rare shells and sold them as a commodity like any other fishing enterprise. Natural resources such as scallops, abalone, oysters, mussels, clams, trochus, pearl shells, pipis, etc have been exploited by humans as food, bait, ornaments and precious stones in the form of pearls and pearl shell ornaments.

Even in this modern day when everybody is so aware of the natural environment and that many of the ocean's resources have been plundered beyond recovery we still tend to only think of shells as inanimate objects to be collected, or used as road fill, ornaments such as lamp shades, or door stops.

Little thought is ever given to the living animals that have lives and histories and are capable of unbelievable behaviours and wonderful abilities.

Few can understand that these incredible life forms are far more than meets the eye and that humans can improve the well-being of their lives just by understanding that nature has the key to all our problems and we can learn so much if we slow down a bit and bother to look around us.

Not so long ago we raped, pillaged and destroyed nature in all its forms as if it was our "God given right". Indeed, on the Bible I was brought up on, dominant male humans were encouraged to utilise or destroy anything they saw fit, especially if it did not bow to their beliefs. This is a familiar theme in other religions I made it my business to reason with in younger days.

Due to the new age of concern about nature and the health of the planet in general (and the fact that we have destroyed a large amount of the planet's living resources) our attitudes are slowly giving way to becoming a bit less plundering.

Shell collecting has been a worldwide "business" and vast areas and species have been all but wiped out by the insatiable appetites of souvenir collectors. While in my day divers collecting Helmet Shells to be killed and used for doorstops was normal, today we know and care a little more.

Horned Helmet Shells

The horned helmet shell (*Cassis cornuta)* is a large (350mm) carnivorous gastropod, which lives in the shallow waters of lagoons, on sandy sea floor along the northern reaches of the Great Barrier Reef, and across the Indo-Pacific.

The mollusc is generally found in colonies, although individuals may disperse over a wide area. Due to heavy collecting for the tourist trade to be used as door stops and lamp shades through the years, the species is now completely protected within Australian waters. During the day most specimens are dormant, lying partly buried in the sand in depths of 5 to 20m.

Their food consists almost entirely of heart urchins, which they attack by rasping a hole through the test of the urchin with their radula and using their proboscis to suck out the soft parts.

Sexual dimorphism exists, with the males being smaller in size and having fewer but larger knobs on the shoulder of the shell, while the female is more rotund, is larger shelled, and has uniform smaller knobs on the shoulder of the shell. A small brown chitonous operculum is present on the foot, but this seems of little use for protection as it only covers about one quarter of the total aperture length.

A Giant Helmet Shell bulldozing its way across the sandy bottom searching for buried heart urchins.

Horned helmet shells use two methods of digging. One is to burrow ahead at an angle, using the wide flanges of the shell aperture to push away the sand. At other times they will rise up on their strong foot and bring the shell down hard on to the bottom, displacing the sand around and forming a depression. By repeating this process they are able to excavate a shallow hole.

At night the horned helmet is quite active, crawling over the sand and low profile reef in search of prey. As with other prosobranch molluscs, the eyes are not capable of forming clear images and merely act as light receptors. All other functions and senses are thought to be similar to other prosobranchs.

This small amount of text contained most of the information known about living Cassis cornuta in Australia at the time.

Getting Sorted at Samaurez

17/09/74 Samaurez Reef, Coral Sea, 6.30-9.30 pm:
While carrying out my normal recording functions under-water, I was on my way back from my third shallow-water dive of the day (7m) when I passed three horned helmet shells in close proximity to the charter boat. At that time I took little notice other than to assume that some other divers had collected them, taken them on board, and that the skipper had ordered that they be thrown back as they belonged to a protected species (this later proved to be correct). The shells had landed in a triangle such that each was about 5 metres away from the others. Two of them had landed with their right side up, but one had landed on its anterior end and the entire front was buried in the sand.

It never occurred to me to stop and turn this shell over, as my mind was full of an hour's observations, in which I had taken two rolls of film on behaviour involving several new records, and I had a new species in my collecting bag. I was also anxious to change film, have my tank filled and get back into the water.

It was just coming on to change over time and I wanted to be back under water at dusk to see what happened in this area when it got dark. Little did I know that by ignoring that shell and swimming past it, I would set the scene on one of the most exciting observations of my (then) 16 years in the sea.

Within the hour I was back in the water and as I swam up to the anchor line there was still enough light to see that the two shells were crawling towards the buried one. I continued the dive and an hour later, low on air and with only two shots left in one camera, I retraced my way to the anchor line and froze at what the torchlight revealed.

The two helmet shells were now in tandem and were crawling around the shell that was partly buried, in a tight circle. They had furrowed a depression around the immobile shell, having dug away the sand with the front flanges of their shells as efficiently as if they were a pair of miniature bulldozers.

Two Giant Helmet Shells combining to excavate sand from around their stricken co-specific. What is unbelievable about this is that it was being done in tandem; in pitch-black conditions without the benefit of eyes or any other form of communication we lowly humans can even understand.

In the 16 years of working underwater I've seen a thousand impressive sights and a thousand new ones, but nothing like this. I could hardly believe what was happening, but took the pictures anyway.

Lying on the bottom in the dark, barely daring to breathe, I watched two "unintelligent, unemotional" invertebrates, without vision, or any known form of communication, with pea-sized "brains" and no reasoning mechanism that we are aware of, combine their actions to assist another of their species in trouble.

By the time I swam on to the duckboard of the charter boat I was shaking from head to toe, my hands wouldn't work and my feet had a will of their own. Those who saw me thought I'd had a scare. Scared wasn't half of it. I was awe-struck. The tears poured from my eyes and sobs wretched my chest.

But why? Why should I let this example of innate behaviour response, triggered by some unexplained stimuli, affect me so much. I don't know. Maybe because I'm human. Here was a survival technique unheard of in marine invertebrates. What if, because of the effects of storms and cyclones, horned helmets couldn't right their own shells from certain positions on the sand and depended upon a special "May Day" chemical release which others in the immediate vicinity could pick up and respond to! All hypothetical, of course, but it did provoke thought. Thought or not, the clashing of tanks and equipment brought me quickly to my senses; several other divers were getting their gear ready to dive later that evening. Realising what effect the presence of other divers might have on the concluding stages of this epic, I quickly had my tank filled, changed films in the cameras and while the others were having tea, I once again rolled off the duckboard into the cold black depths.

The scene had entered another phase. Both working shells were now actively engaged in pushing the partly buried shell along on its side from behind. With slow methodical determination they had manoeuvred it into a position where it could be turned back onto its normal underside. I watched enthralled as one reared up on to the turned shell's back and pushed from a higher aspect, providing the leverage that eventually righted the upturned shell.

By digging out a trench around the fallen shell and pushing it along from behind and the side, they were successful in turning it over onto its

I watched for as long as my air lasted and with my last frame, exposed a final record of the three shells, now all right side up. There were two big males and one little male, almost siphon to siphon, and the little one had buried a few centimetres, perhaps seeking the family security of the sand after several hours of exposure. Three molluscs, just touching, just being, for a moment in time that was mine.

At that instant I didn't care too much for computer analysis, innate behaviour mechanisms or key stimuli. I hated what my brain would eventually do to that scene. I cursed every bit of cold calculating behavioural biology I'd ever learnt, every critical realism, and casual analysis. I hated beyond hate science, myself and the world in general, because I knew in my heart that this, like a thousand other encounters in the animal world must fade into the objectiveness of a thousand unknowns. Because science has strict and exacting principles, of which feelings play no part, one is not supposed to evaluate animal behaviour in terms of human experiences, behaviours and emotions. To do so is termed to be anthropomorphism—the ascription of human characteristics to that which is not human—and if science were a religion, then anthropomorphism would get you ex-communicated, to say the least.

Nevertheless, regardless of how, or why, I saw two lovely invertebrates spend several hours saving the life of another 'lowly' invertebrate and nobody on this planet is going to convince me otherwise.

Since this story was published many years ago, science has conducted experiments and found that these facts to be true. Fancy that! We have really advanced very little in regard to our knowledge of the interactive behaviour of sea creatures. If as admitted we only have 1% of the world recorded there is still a lot to keep many thoughts of scuba diving underwater naturalists enthralled for the next couple of hundred years.

"The sequel to one of the most moving events I have ever witnessed in the sea. The three giant molluscs (all males) have come all together after the drama, in a siphon to siphon group, as if they were "bonding" or providing assurance to the younger one."

CLEANING AND RESTORING SHELLS

Margaret Morley

This article was originally published in Poirieria Volume 16, No 4 September 1992 and has kindly been reprinted with permission of the author.

Before delving into the many and varied ways of cleaning shells I pose two questions :

1. Do you "need" live taken shells? If you have convinced yourself that the answer is "yes" then,

2. Should shells be cleaned? Recent trends emphasise the importance of malacology rather than conchology. That gem specimen in your collection may be useless to scientists because the animal's body parts with their unique DNA have been flushed down the plug hole!

However, let us assume you have decided to take live specimens. Consider the least number that will suffice. Remember, the more you collect the more they smell! Leave damaged or immature shells behind to breed. While collecting and throughout the cleaning process, record full details with each shell. To quote Goldsmith: "Memory is a fond deceiver". Beware of using ball point pen—it won't write in the rain, and totally disappears if you put in contact with methylated spirits! Some collectors use a pencil in the field. Most paper will disintegrate if left in water. Tyvek is ideal, it survives all treatment.

Methods

Dead Shells

If the shell is dead, just soak for one hour in fresh water, then wash gently if fragile; or scrub with an old toothbrush. A soak in dilute Janola may bring up the original colour. Rinse well and dry thoroughly.

Hermit Crabbed Shells

You may need to know which hermits respond to which methods! Some Brisbane crabs will shake out. Tropical Island hermits will hop out of the shell if you whistle into the aperture (if you have the knack!). A lighted cigarette applied to the shell spire often also works. Less dramatically, try leaving them sealed dry in a plastic bag somewhere warm—they die extended from the shell. The whole body can then be removed with tweezers. A steady pull while rotating the shell is most likely to be successful. A large shell, eg *Charonia*, can be suspended upside down overnight, and the hermit crab will fall out.

Tape string onto spire and suspend shell upside down.

Bivalves

Strong shells can be frozen and will gape. Soak more fragile shells in fresh water. When the valves gape the body can be flushed out, eg *Offadesma angasi*. The attachment of the adductor muscles often needs a scrape. Close the valves and secure while drying with a strip of paper towel and a turn of masking tape. Beware the use of rubber bands or twisties; as if forgotten these can permanently stain or damage the shell. If a bivalve dries open, try immersing the hinge in hot water and detergent—this relaxes the ligament and the valves may then be closed .... Carefully! When clean and dry treat the hinge with the chiton preservative—50% glycerine, 50% isopropyl alcohol. It penetrates easily, keeps the ligament supple, and does not go mouldy if reapplied annually. Too much glycerine may attract insects! Check condition annually in humid weather.

Live Univalves (under 10mm)

If you wish to prevent the animal and operculum withdrawing out of sight, allow the animal to become groggy in air overnight or wait until it does not respond briskly to prodding. Then immerse in 70% meths (do not use pure alcohol) for one or two weeks according to size. (Using 100% meths dries out the animal too much for use in dissection work and the purple dye in meths may stain shells.) Occasionally you may spot a very pale bottle of meths in the supermarket, or you can buy clear meths from a chemist. When caught without meths, surgical spirit or spirit drinks such as gin make temporary substitutes.

Microscopic shells should be washed in fresh water, then immersed in 50% ethanol followed by thorough drying.

Live Univalves (over 10mm)

The trouble begins!

⇒ Bury in the garden : Not recommended in New Zealand. In the tropics especially, protection is needed against rats and pigs. Ants do the job but not quickly enough for holiday-makers. Norman Douglas used to put his shells in a sealed box at the far end of the garden and wait for several weeks until they rotted. They were then hosed out, etc—a possible method if you are patient, but it is easy to forget them! Also, the rotting animal may damage the shell.

⇒ Boiling : Do not boil shiny shells like cowries because the surface may craze; and avoid this method for precious shells. Boiling can be used as a quick method with species such as *Penion* and *Struthiolaria*. Cover the shells with cold water, slowly bring to the boil, simmer for up to 10 minutes (depending on size), then cool until you can handle them. As for hermits, grip the animal with tweezers or dental tool, maintain a steady pull, and rotate the shell as you feel the animal "give". Then rinse and dry.

⇒ Throw at sand : In Aitutaki in the Cook Islands I was shown their method of cleaning cowries. My prize *Cypraea tigris* was forcefully and repeatedly thrown at a pile of sand. Within a minute the body had liquidized and just ran out. There was no shell damage! This is not a good method for the faint hearted!

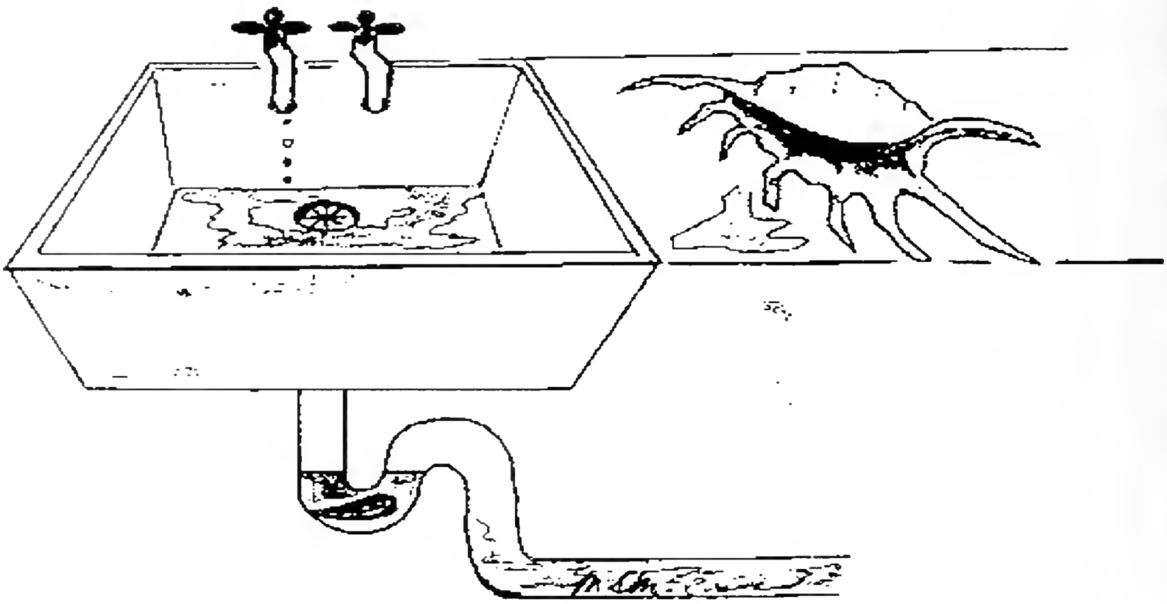
⇒ Soak in old engine oil : After three days of this treatment the body can be hosed out. Despite reassurances, the doubters wondered if this would cause staining of the shells. Shells can also be soaked in oil, ie baby oil, to lessen encrustations.

⇒ Microwave : For best results start with live shells, but it also works for frozen specimens. It is not suitable for small shells or rotten animals. Disasters like exploding shells have been reported, so proceed with care. Put the shell on a paper plate and cover with a paper towel, or pop inside a bag. The animal comes out with an audible 'pop'. Suggested times on medium power are small (50 seconds), medium (50 seconds to 1.5 minutes), large (1.5 to 6 minutes—check every 2 minutes).

⇒ Fridge : Live taken specimens for dissection can be kept alive for up to a week in a container with seaweed (no seawater). If deep frozen they are not so easy to dissect.

⇒ Deep freeze : Do not freeze fragile shells as they may crack. Freezing is useful for temporary storage if you are busy. Shells can be brought out in manageable lots at a later date. Also, freezing facilitates removal of the animal. If not all the body is removed the first time the shell can be re-frozen and the process repeated until the shell is clean.

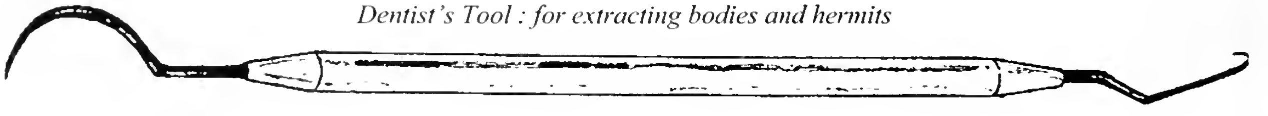
⇒ Plastic box : There is now a plastic box on the market which has a slicker pad in the lid. This keeps specimens cool for the travelling collector.



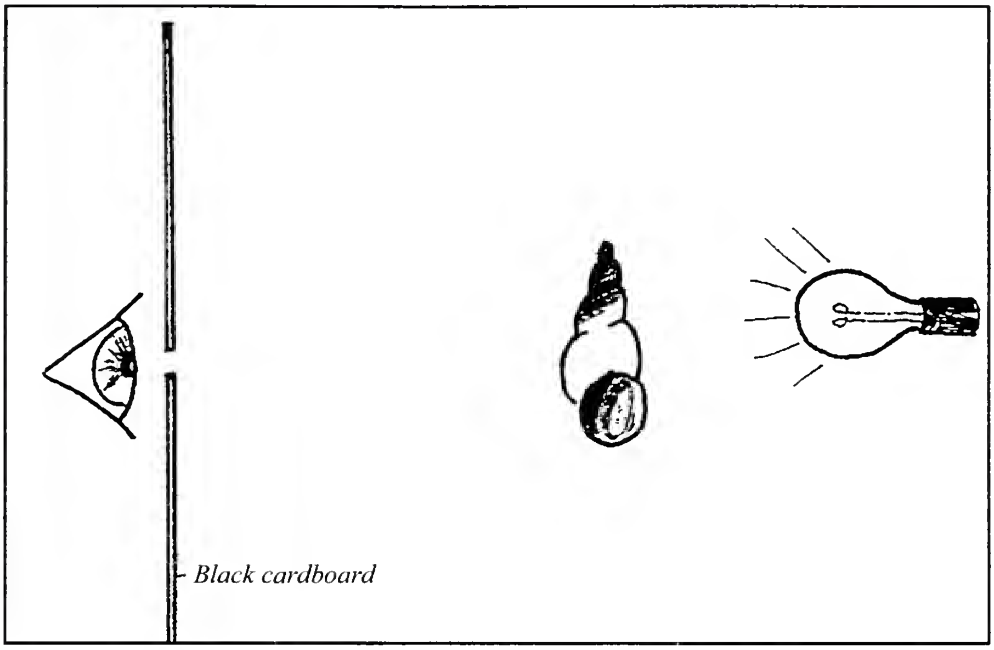
⇒ Washing out : Wait until the animal is well rotted, or alternatively soak for a week in a 50% meths solution. Keep the operculum (NB *Bullina lineata* has one). If you haven't already extracted the operculum, squirt the shell over a bucket or put the plug in the sink. Some washed up shells have the operculum still inside. As well as a sharp squirt from the tap or hose, a quick flick of the wrist may dislodge the animal. A coiled wire tool or dentists tool may help. A size range of fish hooks is especially useful on shells with narrow apertures such as cones. If not totally successful the shell can be soaked in water with a pinch of salt added. Change this water daily to prevent shell damage by acidic water. Resquirt at intervals until the shell is clean.

Recycled Dentist's Tool : broken ends reground to a chisel edge for cleaning shells

Dentist's Tool : for extracting bodies and hermits

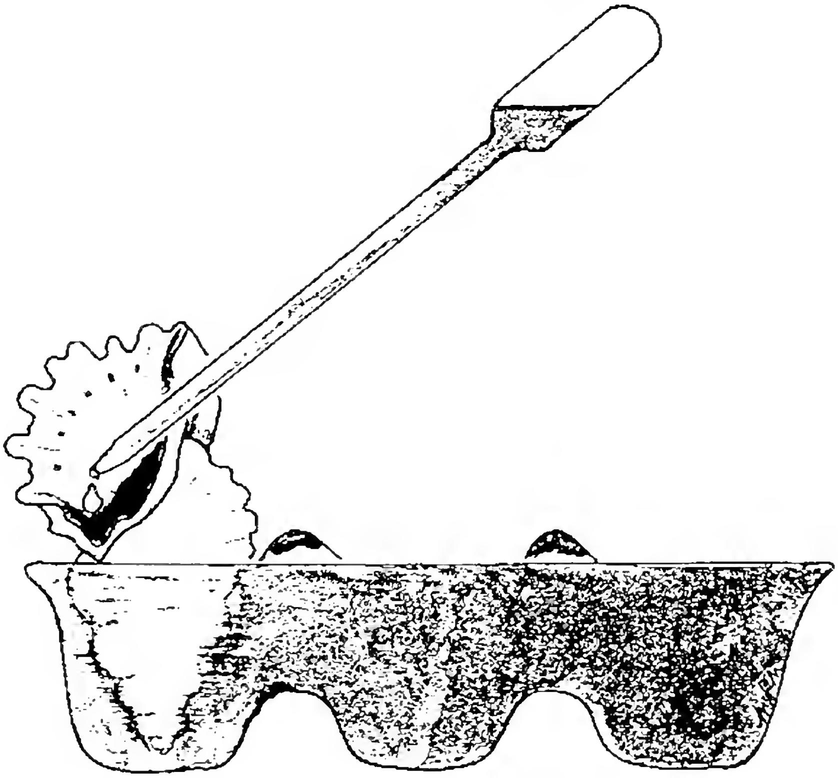


⇒ Desperation measures : The animal still inside and smelling? To check which shells need further treatment, make a small hole in a piece of black cardboard as shown below. Look through the hole at the shell against a strong light. The dark remains in the spire indicate the culprit—further treatment is required.



⇒ Hydrogen peroxide, caustic soda solution, or 100% Janola can be dropped directly into the aperture. An old egg carton is handy support to keep the aperture upwards. Leave for several days and then resquirt to remove the animal parts, repeating if necessary. Caution—beware of damage to skin and eyes from caustic soda. It is essential to soak shells in water after chemical treatments to prevent long term damage. Alternative strategies are dropping 70% meths or alcohol into the aperture and allowing to dry; sealing off the aperture with melted wax, pouring shellac into the aperture and finally for large shells, drilling a fine hole near the apex and blowing out the remains.

Using an egg carton for support



Removing encrustations

⇒ Janola bleach : Completely immerse the shell in a 10-50% solution of bleach for 5 minutes to 12 hours. Start with a weak solution for a short time, and gradually increase the concentration if not successful. Check if the encrustation is becoming loose. A large shell can be treated in a plastic bag which is shaken occasionally. When the encrustation is chipping off use a wire brush, copper for preference, on tougher shells. A sharpened dentists chisel used under a lens is more precise for delicate or precious specimens like *Chlamys* and *Murex* species.

⇒ Diluted hydrochloric acid (50%) : Use with extreme care and use goggles as acid in the eye can blind. People with sensitive skin should use gloves. Heavy, stained, or eroded shells such as volutes respond well to this method. Remember you are dissolving off the outer layer—once too many times makes a hole! Use glass containers. Have a container of water beside you to plunge the shell into and stop the reaction instantly at the desired stage. Dip or paint on the acid briefly and do not allow the acid into the aperture. Vaseline can be smeared on parts not needing more treatments. Afterwards, soak thoroughly in clean water. A final polish with Scotchbrite, wet and dry sandpaper, then Brasso when dry, can recreate the original gloss.

⇒ Lemon juice : I have not tried this –use as for acid, a less dangerous method.

Periostracum treatment

This maintains the natural look of the outer periostracum, eg *Ranellids*. It is essential to keep the periostracum wet during the cleaning stage. When clean, apply either :

⇒ 50% glycerine 50% isopropyl alcohol : This reduces mould. Keep a close check on specimens, especially in humid Auckland. Reapply at yearly intervals. Mouldy spots can be checked with a dab of meths.

⇒ Bob Penniket's recipe : 60% PVA glue 40% water—just paint on and allow to dry. It has the advantage of reattaching any pieces of periostracum that are cracking off.

⇒ Please note that recipes including formalin should not be used as it is a known carcinogen.

Final preparation

⇒ Glue the operculum onto cotton wool using a water based glue. Make sure it is the right way up!

⇒ If needed, write a catalogue number on the shell.

⇒ Baby oil (note from editor : or paraffin oil) applied very sparingly will bring up the colour and gloss on some species. Neopol polish renews the shine on *Cypraea*. Too much of either will attract dust and stain labels.

⇒ Write out the label with full details. Labels should be inside tubes.

Byne's or Museum Disease

Despite the name, this condition is not due to bacteria or fungi; but is a chemical corrosion evidently caused by residual traces of acids or alkalis. It can develop 10 to 50 years after collection, and shows up as a powdery white covering. If left, this thickens and eventually penetrates the layers of the shell. A small shell may totally disintegrate. To prevent your collection suffering, note the following points.

⇒ Seal any particle board used in cabinets with several layers of varnish.

⇒ Do not use oak cabinets as they give off acidic fumes.

⇒ Have your cabinets well ventilated.

⇒ Metal boxes and shelves are ideal.

⇒ Cheap soda glass emits alkaline fumes.

⇒ Microscopic shells are best in gelatin capsules inside another tube for protection.

⇒ Avoid cotton wool, especially in tightly sealed containers, as both caustic and acid is used in some manufacturing processes—cellulose is better.

⇒ Corks give off acidic fumes, but plastic stoppers are OK.

⇒ Foam plastic eventually deteriorates and shells stick to it, and the same goes for Blu-tak.

⇒ Do wash and dry all specimens before storage.

⇒ Check your collection regularly.

If Byne's disease is noticed, wash off all traces and seal the shell surface with oil.

Summary

Most shell books give shell cleaning information but different sources often give conflicting advice. I have either used the methods discussed in this article myself with success, or have had them personally recommended to me. However, I hope this article will spark further debate.

Acknowledgements

To the late Norman Douglas and Bob Penniket for much information and inspiration. Thanks to Peggy Town for the methods involving using acids, and to the many members of the Conchology Section for their contributions.

References

Poirieria Vol 1 Page 97 "the problem of cleaning shells" by TP Warren.
Poirieria Vol 5 page 32 "preserving Chitons"
Poirieria Vol 14 No 2 page 6 "periostracum preservation" by Norman Douglas
"Seashells of Southern Africa" - the section on how to look after the collection
"New Zealand Mollusca" by AWP Powell, Page 1
"Compendium of seashells" by R Tucker Abbot and S Peter Dance, Page 14

WHAT TO DO WITH YOUR COLLECTION

Peter Poortman

Collecting shells is an enjoyable and educational hobby.

But as the years go by, a collection can become a burden, especially if it is big and takes up a lot space.

In some cases it may take up an entire room which could have been put to better use, for example to accommodate someone. In other cases it may be a deciding factor in not moving to a better house or location because of the effort required.

Collections need ongoing care and maintenance, and the shells can deteriorate if this is not provided. A neglected collection will eventually lose its value, and rare shells tend to become not so rare over time.

So, if the interest has faded and the collection is all but forgotten, it's time for some hard decisions.

But it is difficult to part with something into which a lot of time and money has been invested - not to mention the emotional attachment formed by many good collecting memories.

The easy option is to do nothing, but in the long run that is an unfortunate choice.

A good collection is sometimes lost because the owner passes away without making adequate arrangements for it. But it can also be a burden to a beneficiary who has little time and/or interest to deal with it.

In any case, what use is a collection if those magnificent specimens never see the light of day? - eg by being on display in Shell Shows, or being of some benefit to science.

So if the passion has gone, and your collection is gathering dust, something should be done about it sooner rather than later.

Here are some suggestions:

Auction all or part of the collection

Your shell club or a public auction house could be employed to do this, but they will charge you a percentage of the sales price.

There is often limited space available at shell club auctions, so this option may take years to complete, and the bulk of the collection may not attract many, if any, bids.

Unless your collection is of historical renown, it will probably not do very well at public auction.

Good online auction sites as well as overseas auction sites specifically for shells can be found easily on the Internet. However this option would require a lot of effort to prepare, photograph and describe your lots, as well as packaging and posting.

Sell it as a complete collection

This is a relatively simple option, but the purchase price will likely be much less than you believe to be fair. Some effort should be put into making the collection presentable, and you will also need to make it available for viewing. But most important is the need to advertise it as widely and as well as possible. Deciding on a selling price is difficult, so the best method may be to call for bids over a set timeframe, and the highest bid wins.

Sell it piece by piece

Probably the best shells will sell quickly, and you will then have difficulty selling the 'not so spectacular' bulk of the collection. Most NZ shells are endemic, so you may do better with these on the worldwide market, but foreign collectors normally insist on gem specimens only, and there are restrictions on what can be exported.

Give it to a museum

This is the best option if your collection contains many items of scientific value. It is also an easy way to dispose of the collection, and there is philanthropic comfort in knowing that it will be of benefit to science. But the truth is that some museums do not need or want the bulk of your collection - especially if the collect data is not of a high standard. Rather than giving them the whole collection, it would be better to just let the museum have first pick of whatever it wanted.

Give it away to fellow collectors

This is the best option if you want to dispose of the collection quickly, and are not concerned about recovering the cost of building it. It will also give you a good dose of "warm fuzzies", and you will undoubtedly be remembered fondly for many years by many people. This option would be a huge boost for new collectors who often have difficulty obtaining good specimens for their new-found passion. Your treasured shells will once again be the source of enjoyment, and be given the attention they deserve.

If you are selling your shells overseas, be aware of the ‘Protected Objects Act’ which came into force on 1 November 2006, and supersedes the ‘Antiquities Act’. Amongst other things it prohibits unapproved export of:

"A specimen of an extant or extinct rock or mineral, animal, or other organism or fossil or part thereof including any development stage, shell, or skeletal or supporting element, of which there is not a sufficient selection in New Zealand public collections to define the variation, range, and environmental context of the taxon or object."

Fine for infringement up to $100,000 or 5 years imprisonment. For more information go to www.protected-objects.govt.nz. Essentially this renders the export of nationally important specimens illegal.

Parting with your treasures will be difficult, even if you haven't looked at them for many years.

So it would be wise to take good photos of your entire collection before it "moves on"!

THE SAD DEMISE OF A GREAT COLLECTION

Peter Poortman

Taffy Hook was a member of our CSAMI club in the 1960's and 1970's.

He was an active collector, who through his work on deep sea trawlers and as a diver on oil rigs, managed to obtain deep water material back in the days when very little was known about that fauna.

He collected with Dr Richard 'Dick' Dell (former director of the then Dominion Museum), and found several new species of crabs, starfish, and other marine species.

Taffy had always wanted to be a Marine Biologist but for various reasons that never eventuated. However, he did manage to build an impressive collection of NZ shells, and wrote the following articles in our Poirieria magazine:

- ⇒ *vol 7/2 (Sep 1973) - New Plymouth, The Harbour Area*
- ⇒ *vol 7/3 (Mar 1974) - Kawaroa Reef, New Plymouth*
- ⇒ *vol 8/1 (Sep 1975) - Cowries in Taranaki Waters?*

Over time Taffy's collection of NZ shells grew to about 1200 lots, including many rare species, and was of scientific value.

Wanting to do something useful with it, Taffy decided to lend his collection to Fred and Myrtle Flutey who owned the Paua House near Invercargill where Taffy now lived.

He had an agreement with the Flutey's that his collection would go on display to the public, but what actually happened is best described in Taffy's own words ...

"It was my original intention to photo (slide) my entire NZ collection, but as with many things in our lives it was not completed. It was to be followed by another slide collection of the comprehensive assortment of marine species; crabs, starfish, bristle worms, etc. - some 200 different units all together with the shells.

Richard Dell of Dominion Museum stated it was the biggest collection of an amateur he'd seen - a comment of which I was proud. I had sent three items to the Museum with good results [see publication list below]. Also a Pycnogonid (sea spider) female with eggs, the first time one in this condition had been seen by the museum.

When my entire collection went to Bluff, I asked if he wanted any help in setting it up, as his knowledge was limited, and should have sounded warnings. He declined the offer, two months later I called down to see how he was doing.

Now, most of the shells sat in 2.5 x 2.5 cardboard boxes, with ID label inside. My first horror was to find he had poured some type of glue into the boxes and sat shells in it!

But worse was to come.

I could not see any marine items, he was away but his wife was there so asked the question where are they? "Oh those" she said airily, "they weren't shells so we dumped them in the tip"!

I stood stunned and disbelieving, the collections were in cabinets 1 meter high with various depth drawers and two meters long in all. There was 160 drawers of material all up (shells and marine creatures).

Scared, I asked what about the 8 drawers of glass phials with all the minute material, some 300 species in all? "Oh those, no, they were dumped as well".

I was numb with shock and anger, they didn't own the material, it was on loan to boost the Paua House attraction. He had sorted all the showy shells, anything that didn't stack up, went. A big collection of chitons - gone, limpets - gone, 40 years of work thrown in the tip!

I just had to get out of there, if he had come home I would have 'whacked' him. I will admit I was in tears as I made my way back to car and home.

He rang later, "what was I going on about, it was junk"!!

I will leave you to imagine the remainder of the conversation. So that was that.

There was still a lot of very good material left. Suddenly both he and his wife died and I made the trip to obtain what was left, only to be told by his [grand]son he had bought the place, lock, stock and barrel!

I raised hell. Bluff was in an uproar, as he said he was packing up and taking all the material with him. It was the town's biggest tourist attraction.

I took legal advice but the cost would have been horrendous. The agreement they had signed was watertight, and a trespass order was taken out against me.

Then, one day, in the dead of night a company arrived, packed it all up, and it is still unknown where it is. The Paua went to Canterbury Museum - my material has just disappeared, to a tip I would say. The [grand] son would enter into no talks at all, and now lives in Australia.

So, as they say, that is that."

Publications that refer to Taffy's collection

1. *Records of the Dominion Museum Vol 6, No. 3 pp 13-28, 30/1/1968 Notes on NZ Crabs by RK Dell*

2. *Records of the Dominion Museum Vol 8, No. 15 pp 247-266 27/6/1974 New Species of brittle-stars from NZ by Alan Baker*

MASON BAY, STEWART ISLAND

Bev Elliott

Mason Bay, Stewart Island—the shell collector's dream! Imagine walking along 13km of white sandy beach, the sun shining warmly in a blue sky, white waves dancing on a sparkling blue sea, washing ashore numerous *Phalium harrisonae* and other treasures of the deep. Abundant bird-life, dominated by the friendly Mason Bay Kiwis, and at the end of a perfect day, a gorgeous sunset, for this is Rakiura, the land of the glowing skies!

So when Barry, Leader of the Kaikoura Tramping Group, phoned to say that "Jenny and I are flying to Mason Bay on 9th October; would you like to come with us?" I jumped at this chance of a lifetime! So did Peter, a keen wildlife photographer.

October 9th arrived at last, the little plane landed on the Mason Bay beach, and we stepped out to the grey cloudy skies and wind that seemed to slice right through us—the weather that was to be our constant companion throughout our stay. The dream soon gave way to reality. The shells? - one species, Tuatua, *Paphies subtriangulatum*, millions of them. The birdlife? - about as many bush birds as one would see in Kaikoura, and considerably less seabirds. The kiwis? - numerous footprints on the sand, and a few screeches at night. The botany? - quite interesting, but too early for anything to be in flower. We hauled our very heavy packs to the Mason Bay Hut, and prepared to enjoy our stay.

On day two we trekked the 9km to the south end of Mason Bay. After some distance the Tuatuas were joined by *Zethalia zelandica*, and then a few other species. By the time we reached "The Gutter" (the sand bar that connects Stewart Island and Ernest Island) there were enough species to make a reasonable sort of list—if one had time to spare. It was so far, that the others spent only a few minutes there, before setting out on the return walk. I had brought my tent and sleeping bag as far as Doughboy Track, two thirds of the way down the beach. So I had a little bit of time to look around. On day three I set out to climb Adams Hill. At 401m it should be easy. Five hours later, long after I'd become thoroughly sick of it, a wee gap in the bush gave me a glimpse of a wet and windy grey mound away in the distance. I turned back! A swift movement in the crown ferns beside the track gave me my first glimpse of a Kiwi; it was gone before I even realized what it was.

Day four saw me heading back to Mason Bay Hut. Among the "abundant bird life" on the beach (a few Black Backed and Red Billed Gulls and Black Oystercatchers) was a dark bird like an immature Black Backed Gull—and yet it seemed different. Although I approached it quite closely, it didn't fly off and I thought if that really is a Southern Skua, Peter needs to video it before I try to get really close.

Soon the four of us were all on the beach, gradually edging closer and closer to the Skua, as it fed on a small dead seal. There was no doubt of its identity when we got close, and Peter got some excellent video footage, and even I got a few photos with my 70 zoom lens. At last our trip had produced something new.

Day five was the start of Barry and Jenny's big 10-12 day tramp around the northern coast of Stewart Island.

The skies were grayer and cloudier than ever, and the wind was whipping up a sandstorm. But I wanted to go with them to the northern end of Mason Bay for there, surely I would find a few shells, just as there had been a few at the southern end. I set off a few minutes before they did, down to the beach. Suddenly there was a great screech behind me, and there was a Kiwi, about 2m from the track—head thrown back and beak open as it went through its repertoire of screeches. Then it poked around in the marram grass for several minutes before running up and over a sand dune and disappearing—just before Barry and Jenny arrived. And they were the ones who'd been putting such effort into Kiwi spotting, all to no avail. Seems it's a matter of pure luck.

We walked to the north end of Mason Bay. The sandy beach changed to smooth granite stones, the kind that will roll under your feet and tip you over and break your ankle if not very careful. Barry and Jenny walked on with sure-footed confidence, while I tottered unsteadily along, way behind. There was not a shell to be seen. Even the Tuatuas had given up on this hostile environment. And then after "goodbye and God bless you" Barry and Jenny were gone, climbing up a rope on the track(?) to Little Hellfire. Getting up that steep slippery track with 12 days of food and equipment on your back may be a little taste of Hell, but the weather and temperature had more in common with Antarctica! I was left to make my lone way back along Mason Bay, that bleak and inhospitable piece of coastline. Not a shell, hardly any birds, wind whipping the waves and sand to a crescendo. Not a sheltered nook anywhere where I could sit down and eat my lunch. What an awful place! Yet I was enjoying its wild beauty and majestic fury, even though it was so different to my dream of glorious Mason Bay.

Although the shells are so scarce there, plenty else washes ashore. Mason Bay is a beach cleaner's nightmare! Some of the plastic debris has been put to good use in making novel track markers, but most of it remains on the beach, an unattractive reminder of the way man abuses our world.

And did I find a *Phalium harrisonae*? Yes I did, not on the beach, but on a shelf in a little Hunter's Hut. Normally I wouldn't go poking into a private hut, but this wasn't normal, it was a matter of sheer survival : When I returned to my tent after the Adams Hill walk there arose a storm such as I've never experienced in all my years of tramping. A howling gale and torrential rain were lashing my little tent and threatening to annihilate it. I stuffed most of my gear into my pack, and bolted across the creek getting swamped in the two or three minutes it took to reach the Hut. I had to laugh—there was a cupboard there with "Safe" written on it. Yes, I was safe there. And so was the little *Phalium*, and I hope the finder really appreciates the lovely shell he's got there.

The DOC men I talked with knew nothing about Helmet Shells, or any shells. To my disappointment, they had absolutely nothing off the beach that I could look at, or photograph.

And at the famous Bluff Paua House *(ed : refer article by Peter Poortman, items from the Paua House have now been relocated to the Christchurch Museum)*, my question about the Mason Bay Helmet Shell brought a vague gesture in the direction of a *Cassis cornuta*. It seems *Phalium harrisonae* remains almost unknown.

SHELL SHOW, 2009

The 2009 Shell Show was a great success, and by all accounts was enjoyed by the many participants and visitors. We had almost 200 exhibits, and as usual the standard was higher than ever. The displays were amazing, and visitors well and truly got their money's worth.

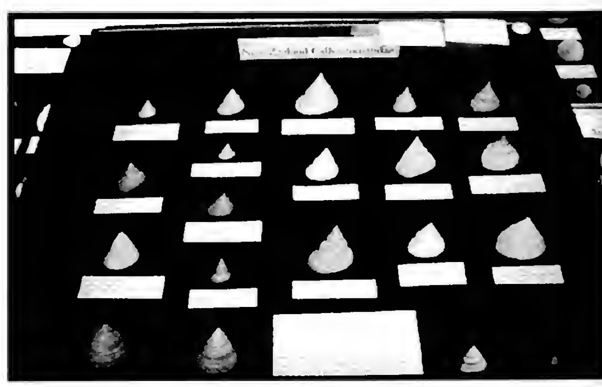
The judges had many difficult decisions to make, but managed to complete their task by 9pm on Friday night - big winners were Heather Smith for her worldwide displays, and Peter Poortman for his New Zealand displays.

We also had a record number of shell dealers this year, including Alistair Moncur from Britain and Marcus Coltro from Femorale in Brazil.

The auction on Saturday was well attended and the bidding for some lots got quite competitive. The day finished with an enjoyable meal and prizegiving at Valentines Restaurant.

Throughout the weekend we had a steady stream of visitors, with Lena Trnski being the lucky winner of the raffle - a beautiful collection of shells donated by Heather Smith.

Many thanks to all the club members who contributed in some way to make this our best ever show.



Organiser's comment, by Peter Poortman

We try to make every show better than the last, and this time there were many changes and improvements. In particular ...

1. more emphasis on the show as a friendly and fun social event rather than as a competition.

2. greater encouragement for novice collectors and first time participants. This time there were four show classes specifically for first-time or infrequent exhibitors.

3. exhibitor rules and conditions were greatly simplified and relaxed. Exhibitors were now given the freedom to exhibit whatever they wanted (eg. number of shells) as long as their display conformed to the class theme and conditions.

4. extensive overhaul of the judges guidelines and paperwork. The usual weighting system was scrapped, and judges could now just use their own discretion. This greatly simplified the paperwork and made the judging process much easier and faster. Judges were also given much better information and controls to ensure that all classes were judged according to its particular theme and conditions, and to ensure that no entries could be overlooked or misidentified.

5. more efficient table layout to accommodate the large number of exhibitors and dealers.

6. the award and trophy presentation process was modified to make it much more streamlined and efficient.

All these changes were a success, and we feel that 2009 was our best ever Shell Show.

Unfortunately though, this did not translate into bigger public attendance numbers. Despite an excellent advertising campaign, public attendance numbers were lower than expected. We can only attribute this to the fine weather over the weekend. Our intention next time will be to hold the Shell Show in mid-winter - preferably on a cold and rainy weekend!

On the other hand, exhibitor and dealer numbers were better than ever. In fact, were it not for the unfortunate absence of the Grange's and the Crosby's, there is no way we could have fitted in all the exhibits and dealer tables.

Also, despite the low number of visitors the hall was a little cramped, so we will probably need to find a larger venue next time - suggestions welcome!

Competitor/Seller's comment, by Doug Snook

It was good to have a small but fit group to establish the tables, etc in position on Friday morning to enable exhibitors to bench exhibits in good time. We were very fortunate to have had Peter Poortman as Show Convenor, ably supported by Heather Smith and our President, Martin Walker. You could say if you want to do well with your exhibits, be prepared to get involved—you just might learn how to be inspired and become a successful winner as well!

With almost 200 exhibits and the standard improving at each show, this makes some of us who have exhibited at Shell Shows since 1978 finding it much harder to gain the coveted 1st prize in any class. It was great to discover that almost every exhibitor gained an award for a placing including a number of first time exhibitors, which I thought was rather special.

Another draw card was 10 dealers—a record number were there attracting many happy customers. Alistair Moncur from Britain, Marcus Coltro of Fermorale in Brazil, Pita Demertzis from Greece, Ron Moylan, Ena Coucom and Barbara Jouvernaux from Australia. Mike and Val Hart, Selwyn Bracegirdle, Doug and Judith Snook, Jim and wife, all from New Zealand.

The Saturday was the most popular day for visitors, possibly part of the reason was buyers wanted to have first pickings from the various dealers with shells for sale, plus exhibitors were keen to see who the judges had chosen for prize winning classes. In fact a cup of tea or coffee was out of the question until well in the afternoon for most dealers.

The end result was a very successful Shell Show which financially was encouraging too, in that we were able to cover all expenses with a few dollars to spare. So thank you all for your efforts and support in what will be remembered as a great time for all that appreciate the beautiful world of shells.

Attendee's comment, by Jan Munroe

On Sunday morning, I arrived at the venue to take up my rostered spot on the door entry. There was a quiet hush in the hall as Shell Club members, dealers and entrants quietly re-viewed the aisles of shell trays carefully realigning trays and labels where required, cleaning the glass covers on their trays and taking photographs of entries that they admired. Fellow shell collectors from out of town were greeted with genuine delight. Bursts of laughter and loud conversation could be heard while fond memories of years gone by were retold.

The doors were officially opened for the day and small family groups began to arrive—first taking their time to view the shells as part of the raffle prize, then moving around the hall to the show tables, and sellers. Clusters formed around visitor's favourite trays and children scurried up and down the aisles before being quietened by their parents. I remembered again what it felt like to come to your first Shell Show and see beautifully displayed those shells that you had only seen in books.

As people trickled out the door, I was told how beautiful the shells were, how incredible the displays were, were they painted? and what an enjoyable morning outing they had had.

A great Show—thanks to the team of organisers for their many hours of time they have put into what proved to be a great success.

SPRING SHELL SHOW, SEPTEMBER 1984

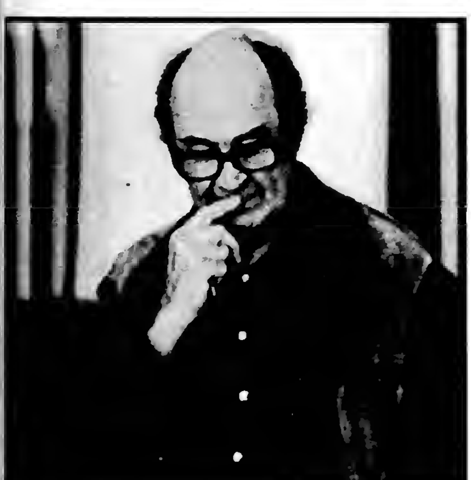
Patricia Langford

The Spring Shell Show weekend in September 1984 was fine and sunny. The North Shore Times had published a picture of Milford members, Stan and Peggy Town at a local beach, with an accompanying story about the Conchology Section and the Shell Show at Akoranga College Hall in Northcote.

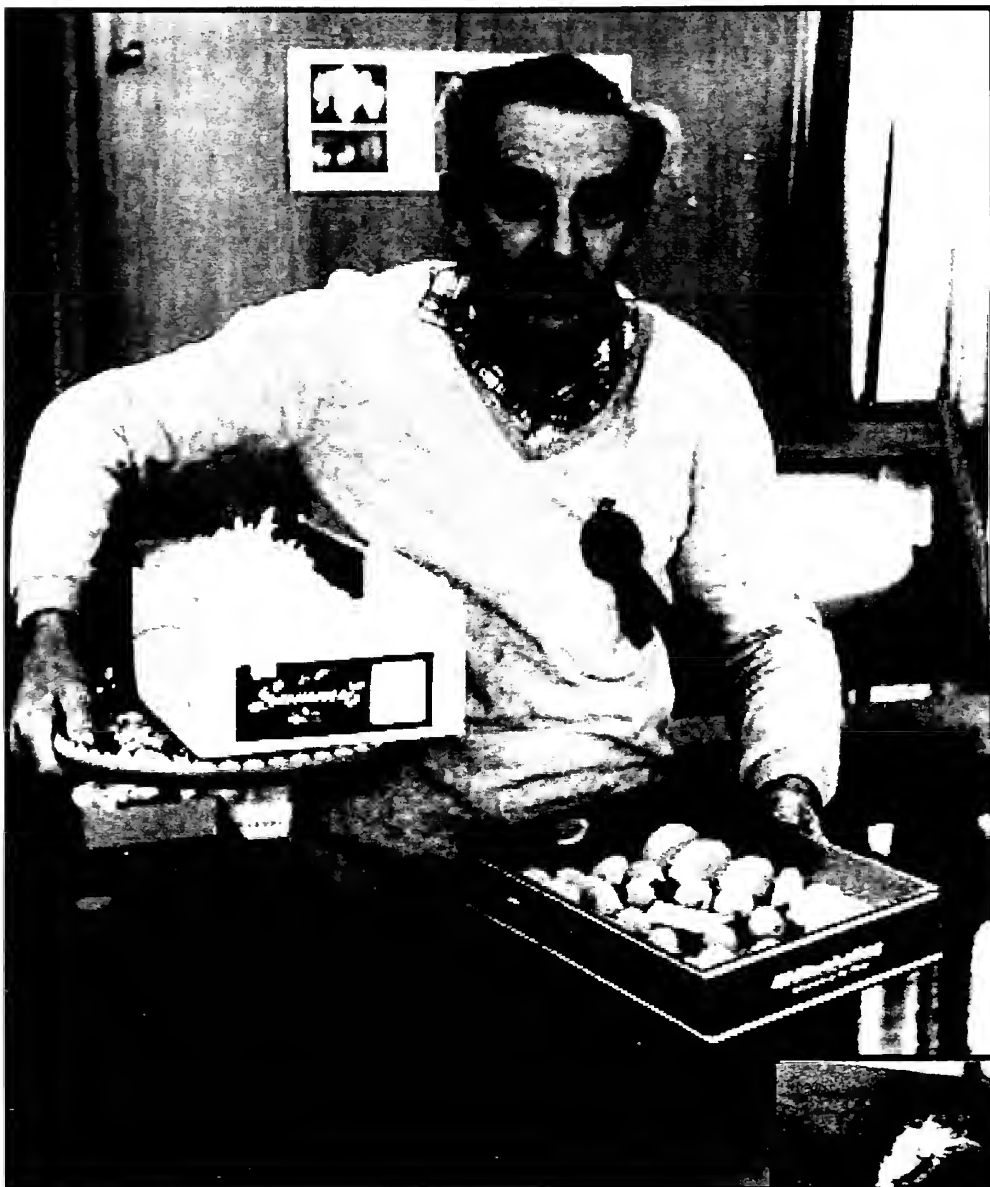
I was asked to be a judge, alongside Walter Cernohorsky, Museum Malacologist. When I explained this is to my three young children they innocently renamed him with a marine theme—Mr Cernoseahorsky. It was understandable because their favourite TV programme was "The Undersea World of "Shark" Cousteau". Sadly, no children matured into marine biologists, in spite of all the years of shell collecting and observing marine life—but I digress.

Norman Gardner and his woodwork students made large wooden trays for exhibits, these were made to the exact measurements of glass panes, loaned by Jim Goulstone, before they were used in his tomato greenhouses. While Bob Penniket set up his favourite trays, his wife Thora decorated the walls of the hall with posters and shell artwork. Who was that young man up a ladder, outside the hall, with the sign? Anne Randall (with friends Norman and Lorna Douglas) made exquisite delicate shellcraft pictures and plaques. Albie Allo, who was our able auctioneer for many years, is seen with Peggy Town and Rae Sneddon. A youthful Steve O'Shea is absorbed in setting up his exhibit—who could have foreseen his lifelong work and passion? Can you spot Dave Gibbs (sporting his distinctive hat) with his young family? Joan Coles graciously awarding a prize to our dedicated landsnail enthusiast—Jim Goulstone. In another group photo she is with Margaret Morley and Stan Town (many years as Treasurer). There is a picture of Doug Snook's mum Olive, unwrapping a shell treasure of her own.

Then there are the judges, easy to pick them, deep in contemplation and difficult decisions. Bob Penniket again, conversing with Kevin Burch about favourites, Maureas and Muricidae. Last but not least, Bob Grange, with arms full of his own treasures. I recall he displayed many deep water New Zealand shells, rarely seen in those days. I believe Bob and Betty's son Ken helped by procuring choice specimens for their collection.



Late Sunday afternoon, I was asked to make my first public speech, and close the show. I can't remember what I said, only the sea of happy faces at the end of a memorable Shell Show.



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Conchology Section Auckland Museum Institute
Incorporating Auckland Shell Club

INSIDE THIS ISSUE

EDITORIAL

My thanks go out to all the contributors who have made this issue possible in the year of 2010. This is also the 80th birthday of our organisation, celebrating its long connection with the Auckland Museum by returning to its origins with a night at the Museum Marine Department. Our Club has been held together by a small, dwindling band of dedicated members and like so many other similar organisations, continues to have difficulty attracting new members and youthful enthusiasts. These are the lifeblood of any club, yet most people prefer to explore both the internet and the wider world, through regular personal travels. Our own members often speak enthusiastically of visits to foreign shores and exotic locations, and interest in the natural world embraces complementary topics such as bird-watching, wildflower viewing, nature photography, and increasing interest in the observation and welfare of marine mammals.

Visits to the humble local beach seem to have been largely discarded in favour of exploration from the comforts and temptations offered by the burgeoning cruise boat industry, and the urgency of exploring distant shores while still relatively pristine—according to the travel brochures. Even the CEO of a major Australasian financial institution makes a quarterly contribution to his publication, with articles on his personal world travels. Life after people still seems a long way in the future. The careful, quiet observers of more modest indicators of the wellbeing of our precious natural world, are more Loners than Lemmings.

Keep up the good work—we need you!

Patricia Langford

November 2010

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We welcome contributions on suitable topics forwarded to the above address.

Views expressed in the "Poirieria" are those of contributors and may not necessarily reflect the opinion of the CSAMI.

LETTER TO THE EDITOR

2 September 2009

Dear Editor,

LETTER TO THE EDITOR: LINNEAUS' COLLECTION IN LONDON

Having read the article by Patricia Langford about Linnaeus in the latest issue (Vol. 34, pp. 24-26) with great interest, I want to take up Patricia's offer (in her editorial) of a letter to the editor, and assure your readers that one statement by Patricia gives a wrong impression – it is not true that "many of the early specimens that Linnaeus based his work on have been lost or sold, and very little is available for present day study". As one who has used this collection on two occasions, I can assure you that it remains largely intact, if a little muddled, and lacking the "large specimens" that Dance (1967) reported sold by the Linnaean Society. All tonnoidean species I had expected to have type material in the Linnaean Society's holdings are present there and, indeed, the only trouble has been that in some cases there seem to be too many possible syntypes, and only those numbered by Linnaeus can be accepted as genuine. Their great significance, of course, is that these specimens, along with the shells in drawings cited by Linnaeus as illustrations of his species and, in some cases, further specimens in Uppsala, constitute the syntypes of Linnaeus' species, the name-bearing specimens that many common species are based on. It is very lucky that this collection has been preserved, as very few of the early collections cited by Linnaeus from before 1758 can still be consulted. The only other two I am aware of are those of Adanson (1757, "Voyage au Sénégal"), which is still largely intact in the Muséum National d'Histoire Naturelle in Paris, and of Gualtieri (1742, "Index testarum conchyliorum"), which belongs to the Department of Zoology, University of Pisa. About two-thirds of it remains in the Certosa di Calci, a beautiful old monastery in the countryside 20 km out of Pisa.

The numbering of Linnaeus' shells is an aspect not mentioned by Patricia. Most genuine Linnean syntypes in London bear a black number (some faded now), inked directly on the shells, usually within the aperture of the gastropods I have examined, traditionally supposed to have been written by Linnaeus (although I think it is a little difficult to prove that he wrote them). They correspond to the relevant species number in "Systema Naturae". Most refer to the twelfth edition, but some refer to the tenth, and a few bear both numbers. My one real difficulty has been with *Cassis tuberosa* (Linnaeus, 1758), for which Linnaeus did not cite an illustration, and for which no syntype remains in London (apparently it was one of the "large specimens" sold off earlier; Dance 1967). However, for this species two syntypes remain in Uppsala, and staff of the Uppsala University Museum of Evolution have kindly supplied photos of these.

Genuine zoologists can arrange access to Linnaeus' collection of historically important shells through the curator, Kathy Way (Curator of Mollusca, Natural History Museum, South Kensington, London) and can sit in comfort in the library of the Linnaean Society, in Burlington House, and examine the specimens at leisure. It is also a great pleasure to see Linnaeus' collection in its beautiful cabinets in the basement, with suitably sized drawers for each type of animal and plant. I was particularly intrigued by the fish types, which have lasted well using a very different preparation technique from modern ones; Linnaeus glued the skin of one side of each fish to a sheet of paper. Most interesting of all to me was to see Linnaeus' own library of early, largely pre-Linnean books on botany and zoology, bound in vellum and labelled in the master's hand-writing. The opportunity probably exists there to resolve some of the mysteries of references cited by Linnaeus, and still causing confusion today (e.g., Boss 1988).

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Yours sincerely,

Alan Beu

Alan Beu (via post)

GUIDE TO FINDING PREDATORY SHELLFISH IN THE WIDER AUCKLAND REGION

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When conducting bioarchaeological investigations and analysis of middens it periodically becomes necessary to distinguish between holes that have been drilled in shellfish naturally (i.e. by predatory shellfish) and those of anthropogenic origin (prehistoric, historic or modern). Much has been written on the act of comparison (Cintra-Buenrostro et al., 2005, Claassen, 1998, Clark and Wright, 2005, Dirrigl, 1995, Kent, 1988, Morrison and Hunt, 2007, Przywolnik, 2003, Sawyer et al., 2009, Schapira et al., 2009) but this relies on having a comparative collection of known origin to compare the unknown samples to. The creation of a comparative collection is simple enough if you have access to unadulterated shells, a cordless drill and prehistoric/historic drills such as Maori drill pumps, but the literature is vague and sparse on the location of shells that have been burrowed into by marine predators. Initial investigations into how to find such shells suggesting beachcombing until suitable shells were found, but given that New Zealand has over 15,000 km of coastline, this would be a impractical so an alternative solution was sought, which was to find where the predatory shellfish could be found, and look on beaches around there for shells with holes in them.

This research question has initially tackled as part of a 2009-2010 summer research project in the Research Centre for Surface and Materials Science (RCSMS) at the University of Auckland, which investigated how surface morphology analytical techniques can be used in the assessment of archaeological samples and evaluating the techniques available for their suitability with different sample types. Each of the samples worked with were specifically chosen to test the limitations of the equipment being used. The techniques available through RCSMS were a conventional (high-vacuum) Scanning Electron Microscope (SEM), making replicas of the samples and then analysing them using conventional SEM, and lastly using the Environmental (or low-vacuum) Scanning Electron Microscope (ESEM). The three sample types chosen were shell, bone and wood. As part of my research I will be conducted research on comparing anthropogenic and natural holes in shellfish, different cut marks on pig bones, and more generalised analysis of fragile wood. As previously discussed, there is a strong foundation in the academic literature about the differences visible macroscopically and microscopically between anthropogenic and natural holes in shellfish, so this research was designed specifically to test the limitations of the equipment being used. As part of this research I needed to prepare shells that have been drilled into by humans (I used a modern electric drill and a Maori pump drill as designed by Dante Bonica (Department of Maori Studies) for Associate Professor Melinda Allen (Department of Anthropology), University of Auckland) and compare these to shells burrowed into by predatory shellfish.

The table over summarises the research I have conducted in sourcing predatory shellfish. This was mostly a search of the literature and the world-wide web more generally, although personal communication also played an important part. After preparing the table, I visited the Muriwai (36°49’54”S, 174°25’29”E) and Bethell’s (36°53’51”S, 174°26’37”E) beaches of Northwest Auckland. I found very few shells at all at Muriwai where only 3 of the 21 shell fragments collected had a hole in them, and all three looked like damage caused by the rocky head.

I found particular luck at Bethell's beach at the high tide mark. Apparently after a storm the beach is so heavily laden with shells that have been bored into that you can collect them by just scooping your hands in the pile of shells. I went a few days after bad weather and there were a lot half-buried in the sand all around the beach. Of the 45 shells collected at Bethell's beach, 15 contained holes or attempts at burrows, most of which looked predatory in nature, mostly around the high-tide mark.

The following table was able to be established by the comparison and combination of the resources listed below.

Common Name	Latin Name	Family	Range	Habitat	Resources
Dark rock shell	*Haustrum haustorium*	*Muricidae*	North, South, Stewart & Chatham Islands	Rocky ground, shady areas	(Morley and Anderson, 2004:106) (Dell, 1965:28)
Oyster borer	*Lepsiella scobina*	*Muricidae*	North & Chatham Islands	Rocky ground, sheltered coasts, tolerant of silt	(Morley and Anderson, 2004:107) (Powell, 1976:pl. 21) (Dell, 1965:28)
Octagonal murex	*Muricopsis octogonus*	*Muricidae*	Northern North Island, to Kapiti and Mahia Peninsula	Rocky and sandy shores. Can live on rocks in muddy situations on sheltered shores	(Morley and Anderson, 2004:103) (Dell, 1965:27)
Cheeseman's trophon	*Paratrophon cheesemani*	*Muricidae*	North Island west coast	Characteristic of Auckland's west coast. Common around intertidal rocks.	(Morley and Anderson, 2004:104) (Penniket and Moon, 1970:52) (Bucknill, 1924:67-9)
Necklace shell / moon shell / Ngaere	*Tanea zelandica*	*Naticidae*	North, South, Stewart and Chatham Islands	Sandy areas (deep water?)	(Morley and Anderson, 2004:96) (Dell, 1965:22) (NIWA (National Institute for Water and Atmospheric Research Ltd. New Zealand), 2009, OBIS, 2009) (Parkinson, 1999:Pl. 11)
Migrating moon shell	*Notocochlis (Natica) migratoria*	*Naticidae*	The North Island north of Auckland	In sand on ocean beaches in shallow to deep water	(Parkinson, 1999:Pl. 11)
		Naticidae		Sand flats	(Powell, 1976:pl. 16, 21, 44)
		Muricidae		Sand flats, deep water, rocky ground, mud-flats, rocky coasts	(Powell, 1976:pl. 16, 21) (Penniket and Moon, 1970:50) (Auckland Shell Club (Conchology Section; Auckland Museum Institute), 2009)
		Both families	Beaches outside the inner harbour	Takapuna, Long Bay, Eastern Beach, Whatipu, Piha, Awhitu Peninsula	(Walker, 2009)

Acknowledgements

Many thanks go to Melinda Allen (Department of Anthropology) for her advice and use of the pump drill, to Rod Wallace (Department of Anthropology) for the use of the archaeology labs, to Bryony James (RCSMS) for supervising this project, to Adele Jeffries for driving me out to the beaches, to John Lavas (biological and marine sciences librarian) for suggesting the Auckland Shell Club and helping me weed through the non-standard literature. This research was funded by a University of Auckland Summer Research Scholarship and the Research Centre for Surface and Materials Science.

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MOLLUSCA DREDGED FROM PORT PEGASUS, STEWART ISLAND

Alan G Beu and Bruce Hayward

89 mollusc species (7 chitons, 43 bivalves, 38 gastropods, 1 scaphopod) are recorded here from small sample dredgings (0-45 m depth) in Port Pegasus, southeastern Stewart Island.

Introduction

Back in the summer of 1989, one of us (BWH) was lucky enough to be among five people who camped at Camp Cove in Port Pegasus, Stewart Island, for 2 weeks (24 Jan-9 Feb) to carry out natural history studies and collections. The trip was organised by Graham Hardy, at the time a fish expert at the National Museum in Wellington. The other three were diving buddies, also interested in fish studies – Brett Stephenson (Auckland Museum), his son Eddie Stephenson, and Clare Ward (a Northland doctor). We hired a fishing boat from Bluff to take us there and back and also hired a 4 m aluminium parker craft and unreliable outboard motor, just large enough to transport four scuba divers and their gear. It was too cold for the divers to be in the water for more than a couple of hours each day and so in between I would utilise the boat and a helper to take dredge samples of bottom sediment from throughout Port Pegasus. I remember the motor broke down on about the second day and for two days I used the oars to pull the dredge along, until a replacement 5 h.p. motor was delivered by another passing fisherman. While the other four were out diving I wandered the surrounding forested hills, enjoyed the scenery and collected lichens (Hayward and Lumbsch, 1992).

The dredge was a small, hand-hauled, 2-litre capacity dredge that sampled the seafloor to a depth of 60-100 mm. A total of 60 samples were taken between 0 and 45 m water depth. A handful of sediment was kept and later analysed for the microscopic foraminiferal composition (Hayward et al., 1994) and the remainder was passed over a 2 mm sieve and the molluscs (dead and live) were donated to AGB, who has recently identified them and lodged them in the GNS Science collections. The list includes a few rare or unusual species and to our knowledge is the first (albeit incomplete) published list of Mollusca from this remote southeastern corner of Stewart Island, and so we thought we should place the records on paper here in Poirieria.

Interesting Records

Most of the molluscs are those expected in this southern, cool-water location, and the fauna is very similar to that in Paterson Inlet, further north on Stewart Island – so, for instance, *Buccinulum pertinax* (von Martens) and *Cominella (Eucominia) nassoides* (Reeve) replace the more familiar *Buccinulum* and *Cominella* species seen further north around mainland New Zealand, and a few typical, coarsely sculptured specimens of *Stiracolpus symmetricus* (Hutton) were dredged alive in 39 m. The list reads much like Powell's (1939) one, although of course much smaller, and Powell (1939) did not include *Aoteadrillia wanganuiensis*. This and a few of the other records call for comment.

Felaniella (Zemysia) rakiura (Powell) (1939, p. 224, text-fig. d, e), described from Ringaringa Beach, Stewart Island, apparently is moderately common in Port Pegasus (collected at Stn 8, 18 m, 1 live, GNS RM6287; Stn 27, 17 m, 1 live, RM6312; Stn 43, 3m, 11 live, RM6326; and Stn 57, 40 m, 1 live, RM6342). It has a more elongate shape and a more anteriorly placed umbo than the common species *F. zelandica* (Gray), and reaches a much smaller maximum size – up to 10.5 mm rather than c. 30 mm (largest 7.7 mm long in the present material).

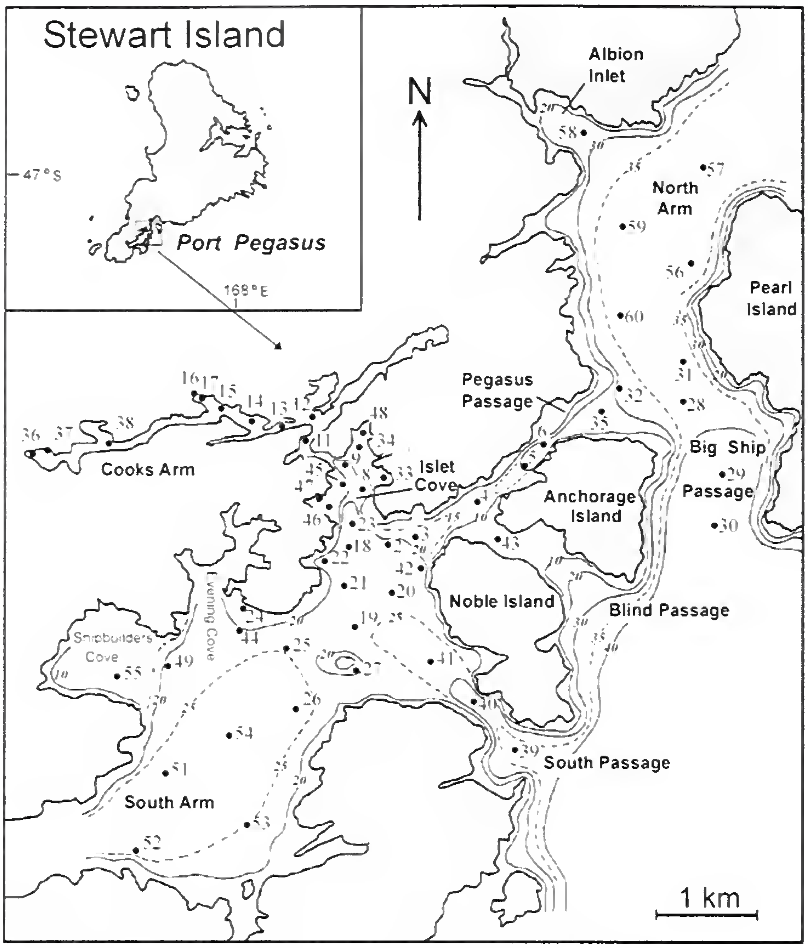

Fig. 1. Location of dredge stations, Port Pegasus, Stewart Island.

These specimens do not show such a strongly subrectangular shape, caused by a straightened ventral margin, as was illustrated by Powell (1939, text-fig. d, e) for the type material, but the shape is clearly more elongate and less obviously circular than in other New Zealand ungulinids. Powell (1939) commented that "Superficially the species has a striking resemblance to ... *Kellia suborbicularis* [Montagu]", but it is distinguished easily by its more solid, less translucent shell, the presence of very weak commarginal ridges rather than a completely smooth surface, and its umbones being much less inflated than in *K. suborbicularis*.

Struthiolaria papulosa (Martyn) is interesting because both a "northern-looking" nodulose shell and a shell of the more usual Stewart Island smooth "*gigas*" form were dredged empty. All shells we have seen from northern Stewart Island are the smooth "*gigas*" form, and Powell (1939, p. 234) recommended the recognition of the apparently geographically constant, clinally varying forms as subspecies, *S. papulosa* "typical" (Powell designated Wellington as the type locality) and *S. papulosa gigas* G. B. Sowerby II, 1842. These forms have not been recognised with formal names by most later authors, as they seemed to intergrade evenly (that is, they form a cline) and do not have hard-and-fast geographical boundaries. However, the occurrence of a strongly nodulose specimen, resembling Wellington shells, at Port Pegasus suggests that the different forms have a largely ecological explanation, still more strongly indicating that the two forms are not subspecies.

Cabestana spengleri (Perry). The single moderate-sized adult empty shell is the southernmost record we are aware of from New Zealand.

Cominella (Eucominia) otagoensis (Finlay) was collected as several fresh, clean, empty shells, mostly in the same samples as *C. nassoides*. These small, sharply and prominently sculptured shells of the group formerly included in *Zephos* Finlay, 1926 are very distinctive. Most specimens we have seen are from Port Pegasus.

Aoteadrillia wanganuiensis (Hutton) is a particularly important record from Port Pegasus, as although this small "turrid" is abundant over a large depth range around most of mainland New Zealand, there are no records in the enormous Museum of New Zealand Te Papa Tongarewa collections from the "extremities" of New Zealand – from the southernmost South Island, Stewart Island, the Chatham Islands, or the North Island north of the central Bay of Plenty. The record from Port Pegasus (1 empty shell, GNS RM6061) suggests that this species is rare near the ends of its range rather than completely absent.

Mollusca Dredged from Port Pegasus

Total list of shells collected by dredging at Port Pegasus by Bruce Hayward, February 1989, if found living the station number(s) and depth (range) are given. If only found dead, no other data is given.

Polyplacophora

Callochiton empleurus (Hutton) Stn. 39, 37 m
Eudoxochiton nobilis (Gray), valve
Ischnochiton circumvallatus (Reeve) Stn. 13, 1.5 m
Leptochiton finlayi (Ashby) Stn. 53, 25 m
Leptochiton inquinatus (Reeve) Stn. 1, 20 m
Notoplax mariae (Thiele)
Notoplax violacea (Quoy & Gaimard)

Bivalvia

Solemya (Zesolemya) parkinsoni E. A. Smith Stn. 8, 18 m
Pronucula ?bollonsi Powell Stns 15, 43, 57, 0.5-40 m
Saccella maxwelli Beu Stns 56, 57, 39-40 m
Barbatia novaezelandiae (Smith)
Glycymeris (Glycymerula) modesta (Angas) Stn. 41, 27 m
Aulacomya maoriana (Iredale)
Musculus impactus (Herrmann)
Pecten novaezelandiae Reeve, juvenile
Talochlamys gemmulata (Reeve)
Talochlamys zelandiae (Gray)
Mesopeplum convexum (Quoy & Gaimard)
Ostrea chilensis Philippi in Küster
Limatula suteri (Dall) Stns 25, 59, 25-38 m
Divalucina cumingii (A. Adams & Angas)
Thyasira peregrina (Iredale)
Maorithyas marama Fleming Stn. 27, 17 m
Felaniella (Zemysia) rakiura (Powell) Stns 8, 27, 43, 57, 3-40 m
Felaniella (Zemysia) zelandica (Gray)
Kellia cycladiformis (Deshayes)
Cyamiomactra problematica Bernard Stn. 43, 3 m
Scintillona zelandica (Odhner) Stns 8, 18, 18-20 m
Neolepton antipodum (Filhol) Stns 13, 43, 1.5-3 m
Cardita aoteana Finlay
Purpurocardia purpurata (Deshayes)
Pleuromeris zelandica (Deshayes)
Pratulum pulchellum (Gray)
Leptomya retiaria (Hutton) Stn. 8, 18, 24, 27, 44, 51, 52, 53, 6-30 m
Moerella huttoni (Smith) Stns 25, 33, 51, 6-29 m
Pseudarcopagia disculus (Deshayes)
Macomona liliana (Iredale) Stn. 15, 0.5 m
Gari (Psammobia) lineolata (Gray)
Gari (Gobraeus) stangeri (Gray)
Ascitellina urinatoria (Suter) Stn. 39, 43, 3-37 m
Soletellina nitida (Gray)
Soletellina siliquens Willan Stn. 24, 6 m
Scalpomactra scalpellum (Reeve) Stn. 30, 45 m
Austrovenus stutchburyi (Wood), juveniles
Ruditapes largillierti (Philippi) Stn. 34, 4 m
Tawera spissa (Deshayes) Stns 18, 26, 48, 53, 3-26 m

Notocallista (Striacallista) multistriata (G. B. Sowerby II) Stns 8, 25, 18-25 m
Caryocorbula zelandica (Quoy & Gaimard) Stn. 41, 27 m
Thracia (Odoncineta) vitrea (Hutton) Stn. 25, 25 m
Cuspidaria trailli (Hutton)

Gastropoda
Notoacmea helmsi (E. A. Smith) Stn. 14, 0.5 m
Cellana ornata (Dillwyn)
Haliotis australis Gmelin
Monodilepas monilifera (Hutton)
Emarginula striatula (Quoy & Gaimard)
Tugali suteri (Thiele)
Trochus (Coelotrochus) tiaratus (Quoy & Gaimard)
Diloma aethiops (Gmelin)
Antisolarium egenum (Gould)
Thoristella chathamensis (Hutton)
Micrelenchus (Plumbelenchus) artizona (A. Adams) Stns 1, 26, 34, 4-26 m
Modelia granosa (Martyn)
Astraea heliotropium (Martyn)
Argalista fluctuata (Hutton)
Merelina sp.
Pisinna sp.
Austrolittorina cincta (Quoy & Gaimard)
Maoricolpus roseus (Quoy & Gaimard) Stns 13, 24, 1.5-6 m
Stiracolpus symmetricus (Hutton) Stn. 56, 39 m
Maoricrypta sodalis Marshall, living inside dead *Struthiolaria*
Sigapatella novaezelandiae Lesson
Sigapatella tenuis (Gray)
Struthiolaria papulosa (Martyn), both nodulose and "*gigas*" forms
Tanea zelandica (Quoy & Gaimard) Stn. 25, 25 m
Cabestana spengleri (Perry)
Zeatrophon pumilus (Suter)
Xymene plebeius (Hutton) Stn. 15, 0.5 m
Buccinulum pertinax (von Martens)
Cominella (Eucominia) nassoides (Reeve) St. 41, 27 m
Cominella (Eucominia) otagoensis (Finlay)
Paxula transitans (Murdoch) Stn. 13, 1.5 m
Austromitra rubiginosa (Hutton)
Aoteadrillia wanganuiensis (Hutton)
Splendrillia sp.
Neoguraleus sp., fine sculpture, inflated, aff. *N. lyallensis* (Murdoch) Stn. 24, 6 m
Agatha georgiana (Hutton) Stn. 56, 39 m
Amphibola crenata (Gmelin)
Siphonaria sp.

Scaphopoda
Fissidentalium zelandicum (G. B. Sowerby II) Stn. 56, 39 m

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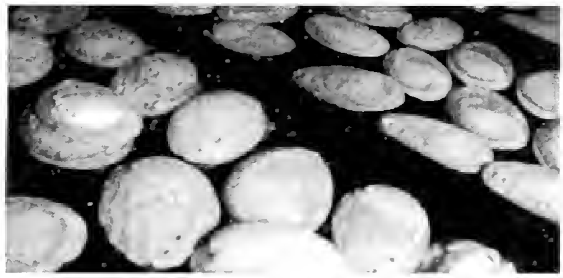
ASPECTS OF ABALONE AQUACULTURE AND POLYCULTURE

Michael K Eagle



The abalone mollusc is a seafood delicacy around the world. Declining wild stocks of the abalone *Haliotis* Linnaeus, 1758 due to natural disease, over-fishing, and poaching has resulted in the global market being undersupplied. Abalone are gregarious gastropod herbivores that feed on marine algae and are confined to a rocky or coral shoreline or offshore reef. There they singly graze on substrates or cluster in crevices for shelter in the sub-littoral zone (see: Morton 2004). There are three modern species of abalone indigenous to New Zealand, of varying size (*Haliotis* (*Paua*) *iris* Martyn, 1784 (Fig.1); *H.* (*Padollus*) *australis* Gmelin, 1791; and *H.* (*Paua*) *virginea* Gmelin, 1791 (see: Powell 1979; Eagle 2002), comparable to the same number of indigenous species in Thailand: *H.* (*H.*) *asinina* Linnaeus, 1758; *H. ovina* Gmelin, 1791; and *H. varia* Linnaeus, 1758. Government funded fisheries research programs in both countries are directed at developing local and export markets to contribute to the gross national product. The National Institute for Water and Atmospherics (NIWA) in New Zealand have several research facilities dedicated to cultivating *H. iris*, at Bream Bay, near Whangarei and at Mahanga Bay, Wellington. Unlike New Zealand where there is constant local demand, only a limited local market for abalone exists in Thailand. Regardless of this, the Department of Fisheries in Thailand (DOFT) is progressively expanding its research program concentrating especially on *H. asinina*, to eventually satisfy a potential strong demand for this meat in neighbouring Asian countries such as China, Japan, Korea, and Malaysia. The Donkey's Ear Abalone, *H. (H.) asinina*, is a tropical species which genetically possesses a spectacular growth rate, exhibits environmental tolerance as well as being a gastronomic delight. It is distributed widely about coastal rocky and coral reef zones in Southeast Asia and the South West Pacific, including northern Australia. Coincidently marine research centres in the Philippines and Australia have also been concentrating on *H.* (*H.*) *asinina* as a potential seafood product.

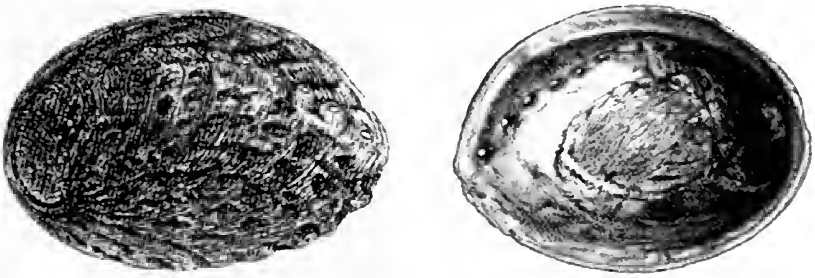


Figure 1. New Zealand cultured abalone *Haliotis* (*Paua*) *iris* (after Suter 1913)

The New Zealand black-footed abalone *Haliotis* (*Paua*) *iris* (Fig. 1), known commonly as the subgenus *Paua* Fleming, 1952 is found naturally ".....in clear water coastal situations, under boulders, rock ledges, and in crevices and caverns, at and below low tide" (Powell 1979: 36). It is commercially and recreationally fished. Aquaculture trials concerned with farming paua were first conducted in New Zealand during the 1980's mainly due to the mollusc's excellent potential for commercial development including export opportunities in sustainable markets with high fiscal returns (currently more than $NZ60 kilogram). However, even with high-performing selected brood-stocks (taken initially from the wild, and later manipulated genetically for improved breeding), cultured paua exhibit slow growth. It can take over four years for cultured *H.* (*P.*) *iris* to reach current market size of 84-100 mm in length, a considerable time when considering economic viability.

Based on other fisheries studies, NIWA staff at the Bream Bay Aquaculture Park estimate that improved growth (which can reduce harvest time) can be 10-20% per generation until optimum. Improved growth may also provide for larger individuals, reducing numbers required to fill customer's orders. The process of artificial spawning has also been refined to accommodate better fecundity. *Haliotis* (*H.*) *iris* cultured in a recirculation system designed to control not only water temperature but also water quality, benefit from a process that more thoroughly cleanses the small volumes of new water required each day than is possible in a flow-through system; *H.(P.) iris* grows 50% faster than those held in a flow-through system (Symonds & Heath 2008).

Polyculture has been practised in Asia for hundreds of years. However, land-based polyculture of haliotids and holothurians in recirculation tanks is a recent innovation. Polyculture involves growing two or more complimentary species together in a single sustainable system, whereas aquaculture involves propagation and rearing of a single aquatic species. Polyculture aims to enhance the productivity of several species by efficient use of ecological resources; the productivity and waste of a primary cultured species sustains secondary species resulting in increased economic benefit. In New Zealand NIWA has established a pilot system at their Plimmerton, Mahanga Bay aquaculture facility in Wellington. There, *H.* (*P.*) *iris* is targeted as the primary crop, with secondary product filter-feeding invertebrates variously trialled; the bivalves *Crassostrea gigas* (Thunberg, 1793) (Pacific oyster); *Mytilus galloprovincialis* Lamarck, 1819 (blue mussel), and the sea-cucumber *Australostichopus mollis* (Hutton, 1872) (Fig. 2). All three have commercial markets and would monetarily offset both capital and operating costs of culturing *H.* (*P.*) *iris*. Unfortunately, in this trial, the oysters suffered thinning, brittle shells and high mortality, and have been replaced by the more resilient, but not as valuable mussel (Miller 2007).

Two key factors which affect the environmental sustainability of culturing abalone and need to be closely monitored are: oxygen and pH levels. Land-based polyculture requires constant removal of suspended solids, faecal material, and excess nitrogen, with monitoring of particulate size, pH., ammonium content, dissolved oxygen, temperature and salinity. It is imperative that water movement suspends organic wastes, initiating self-cleaning and reducing maintenance labour. Agitated water is circulated through tanks containing filter-feeding bivalves or holothurians, before passing to settling pans, and then protein skimmers for final removal of residual organic detritus and bacteria. Tanks of seaweed filter the water next to remove excess nitrogen, particularly ammonium, before returning to the abalone tanks.

Optimum growing conditions for juvenile *H.* (*P.*) *iris* (20-30 mm) are in moderately flowing water between 18-20°C and pH 7.8-8.2. At the NIWA facility *H.*(*P.*) *iris* are fed an artificial diet supplemented with the red seaweed *Porphyra viridentata* and *P. cinnamomea* local to the Wellington region. Reasonably large numbers of the sea-cucumber *Australostichopus mollis* (135) can potentially remove the entire organic waste produced by 125 kilograms of *H.* (*P.*) *iris*. However, it appears that this species of sea-cucumber can only grow on the waste of *H.* (*P.*) *iris* fed on fresh algae or kelp flakes, not the artificial diet currently utilised by the New Zealand abalone aquaculture industry (Miller 2007).

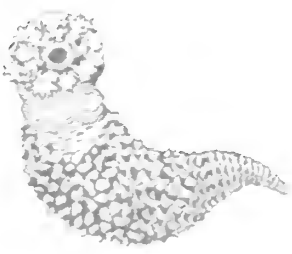


Figure 2. New Zealand Beche-de-mer *Australostichopus mollis*.

Artificial breeding of the *H.* (*H.*) *asinina* species was first achieved at the DOFT Eastern Marine Fisheries Development Centre, Thailand in 1989 from wild stock (3.60-9.35 cm shell length) gathered from reefs around Samet Island in the eastern sector of the Gulf of Thailand. Monitored culture trials and limited harvesting has occurred since then. Suspended plastic plates (30 cm sq.) separated with a regular interval of 2 cm between them has proven efficient in capturing *H.* (*H.*) *asinina* spat after induced spawning. *Haliotis* (*H.*) *asinina* reared in through-flowing holding tanks and fed on the diatom *Nitzschia* sp. (which propagates on the surface of the plate collectors), nurture the mollusc until about two and a half months of age when additional collectors are introduced into holding tanks to increase living space. At about five months of age the collectors are replaced with artificial shelters under which the young abalone tend to congregate and the marine algae *Gracilaria salicornia* is fed to them. *Haliotis* (*H.*) *asinina* reach 42.7 mm. in mean shell length in one year, approximately one third of the time taken for *H.* (*H.*) *iris* to reach a similar size; probably the fastest early growth rate recorded among abalone species. Only *H. diversicolor* Reeve, 1846 from the S.W. Pacific at one year of age is nearly comparable in growth, whereas growth rates in mean shell length of other haliotids are (mm): *H. iris* from Wellington, New Zealand 19.1; *H, corrugata* Wood, 1828 from Baja, California 18.3; *H. fulgens* Philippi, 1845 from Baja, California 29.7; *H. rufescens* Swainson, 1822 from Baja, California 15.6; and *H. sorenseni* Bartsch, 1940 from Monterey, California.13.4. Survival rate of *H. asinina* covering a growth period of one month to one year is about 93% (Singhagraiwan & Sasaki 1991). Australian specimens of *H. asinina* have been the subject of a DNA investigation into the molecular mechanisms that control development, growth, reproduction and shell formation (Jackson & Degnan 2006).

At the Aquaculture Department, Southeast Asian Fisheries Development Center, Tigbauan, Iloilo, Philippines evaluation of the growth rate of *H. (H.) asinina* fed three different diets for four months resulted in varied rates of growth at different ages. *H. asinina* juveniles fed locally sourced red alga *Gracilariopsis heteroclada.* combined with an artificial diet grew faster in both total body weight and mean shell length than those fed *Kappaphycus alvarezii*, another locally sourced red algae.

Figure 3. Asian and Australian cultured *Haliotis* (*Haliotis*) *asinina* (after Van Nostrand 1956).

Juvenile *H.* (*H.*) *asinina* fed only an artificial diet produced more weight than those fed *G. heteroclada* for the first 90 days, but abalone fed *G. heteroclada* grew faster from Day 105 onwards. In terms of mean shell length, the artificial diet produced faster growth rates than *G. heteroclada* for the first 75 days but from Day 90 onwards, faster growth rates were observed in juveniles fed *G. heteroclada.* Reductions in daily growth rates of juveniles during the latter phase of the growth trial were attributed to energy being utilised for gonad development. *G. heteroclada* promoted high growth rates over a long-term period (360 days) and is considered to be best suited for abalone land-based farming in the Philippines (Capinpin & Corre 1996).

Abalone reared in land-based aquaculture facilities require much better water quality and are less adaptable to temperature fluctuation than many marine fish. Haliotid species generally are not efficient at pumping water over their gills. Consequently, even slightly lowered oxygen levels in the water column reduce growth rates in the mollusc. The metabolism of the animal produces carbon dioxide that, when released by the abalone dissolves in seawater forming acids that lower the pH, acidifying the water column. Enough acid will eventually dissolve the shells of abalone so that an alkaline substance (such as baking soda) must be added to aquaculture tanks to counteract the effect of carbon dioxide on them and keep pH levels in a manageable, but inexpensive equilibrium. Ultimately, any abalone culture project must be able to control disease and natural pathogens when growing product and produce a constant supply of premium-grade specimens that grow quickly to market size near to or within reach of that market.

Haliotis (*H*) *asinina* has significant potential as a target species for land-based polyculture in Thailand, Australia, and the Philippines when combined with raising local sea-cucumbers (e.g. *Holothuria scabra* Jaeger, 1833 from Thailand, better known as 'Beche de mer' which is used in the production of an Asian dish named 'trepang') As the world's oceans warm and seas become more acid with increasing quantities of dissolved carbon, mollusc farming will provide an alternative fishery for marine meat and if required, a hatchery for reseeding the wild.

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HINEA BRASILIANA ALIVE AND WELL AT NORTH CAPE

Bruce W Hayward and Margaret S Morley

Introduction

Hinea brasiliana is a distinctive yellow-brown and white gastropod that lives around mid-high tide mark on rocky and boulder shores. It often seeks the shade of boulders and cracks during the heat of the day. Powell (1979) indicates that it is abundant on the shores of New South Wales, and the Lord Howe and Kermadec Islands. He also records that prior to 1968 it was only known from rare specimens washed up on Northland beaches, but in that year a thriving population was found at the end of Rangiawhia Peninsula. On that basis it has been included in the list of native Molluscs of New Zealand.

Our recent enquiries to the Auckland Museum and Te Papa Museum and a circular request in the monthly newsletter of the Auckland Shell Club suggests that this species has not been collected along the mainland New Zealand coast since 1968, although it was recorded in abundance on the Moturoa Islands, off Rangiawhia Peninsula in 1976 by Grace and Puch (1977). Our enquiries turned up several additional unpublished records from specimens in the museum collections. In this note we report that another population of *Hinea brasiliana* is alive and well at North Cape and has been there continuously since it was discovered by one of us (BWH) in May 1967 (Chapman, 1967).

Family Planaxidae

Hinea brasiliana (Lamarck, 1822) Figs 1-2

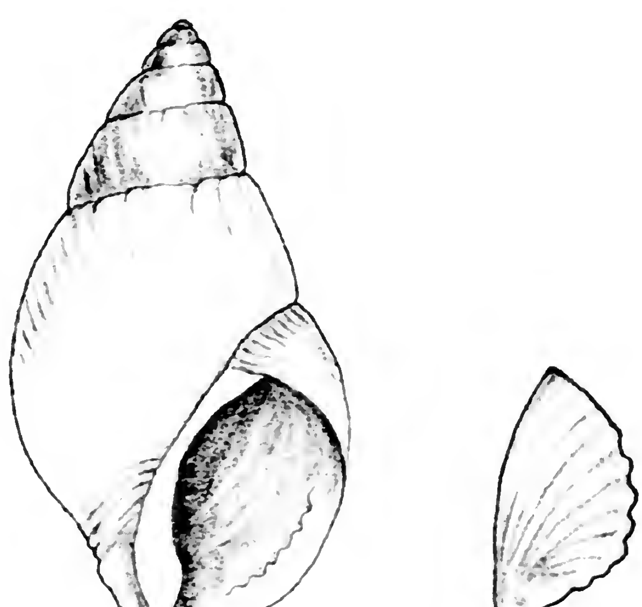

Fig. 1. MSM drawing of specimen and operculum of *Hinea brasiliana* from North Cape. Specimen length 1.5 cm

Description

Shell solid, whorls slightly convex, smooth or with weak spiral grooves. Base with several stronger spiral grooves. Aperture narrow, constricted by callus; columella heavily calloused. Outer lip thin at edge, greatly thickened internally, with weak lirae on thickening. In the specimens examined these lirae (dentition) inside the outer lip of the aperture varied in strength. Anterior canal wide, posterior canal narrow. Colour white internally; the external of the spire on fresh specimens is purplish-grey, fading to white on the body whorl, with thick yellowish brown periostracum, partly eroded from spire in live shells and rapidly lost in dead shells. The animal is creamy white and can retreat well within the aperture. Length 20 mm (www.seashellsofnsw.org.au). In live taken specimens, the dark tan operculum was serrated (Fig. 1) matching the lirae inside the outer lip of the aperture to seal against drying during long periods out of the tide. This ability to resist drying-out was demonstrated by one specimen that was still living after 18 days out of water.

This is one of the few marine gastropods recorded to exhibit bioluminescence. Ponder (1988) found that specimens kept in a container in a dark room emitted a bright blue-white light for up to a minute when disturbed.

"The species is gregarious and occurs in discrete populations among rocks and rubble in the midlittoral zone along exposed rocky, high energy coastlines. Populations usually live in somewhat protected areas not in direct contact with large waves. Individuals are found in clusters under rocks, in moist, dark places during low tide, but become very active and rapidly disperse when submerged by incoming tides" (Houbrick, 1987).

Regional distribution: East Australia from South Queensland to South Australia, Lord Howe I., Norfolk I., Kermadec Is and east Northland, New Zealand.

Fig. 2 Specimens of *Hinea brasiliana* from North Cape.

Records from mainland New Zealand and Chatham Island

1. Chatham I. (collector unknown, pre 1992), AK138388 (1 specimen).
2. Little Barrier I. (Webster, c. 1908) AK126076 (1 specimen).
3. Bland Bay (date & collector unknown), Peter Poortman collection (3 specimens)
4. Bay of Islands (recorded in Suter, 1913).
5. Whangaroa Harbour (W. La Roche, 1924), AK138389 (1 specimen).
6. Rangiawhia Peninsula (= Karikari Peninsula):

a. Dec 1968, bay opposite Moturoa Is (collected by Michael Spencer), Te Papa M.084190 (1 specimen), AK138387 (3 specimens).
b. pre 1970, Moturoa Is group (collected by Peter Jamieson), Te Papa M.081582 (1 specimen).
c. May 1976, Moturoa Is group, Whale I. (recorded by Grace and Puch, 1977, p.61) (no specimens).
d. Aug 1985, Rangiawhia (collector unknown), Peter Poortman collection (9 specimens).
e. Sep 1985, Northland (collector unknown, specific locality unknown), Peter Portman collection (2 specimens).

7. North Cape (Chapman, 1967):

a. May 1967 (recorded by BWH and Kings College Field Club, Chapman 1967), (no specimens).
b. Dec 1983 (collected by F.J. Brook and BWH) F.J. Brook collection.
c. Oct 2009 (collected by A. Loughnan) Auckland Museum collection AK119040 (3 specimens).
d. Spirits Bay beach washup (unknown collector or date) Te Papa M.117819 (1 specimen)

This specimen may have been derived from the North Cape population or a similar remote habitat further along the coast towards Spirits Bay.

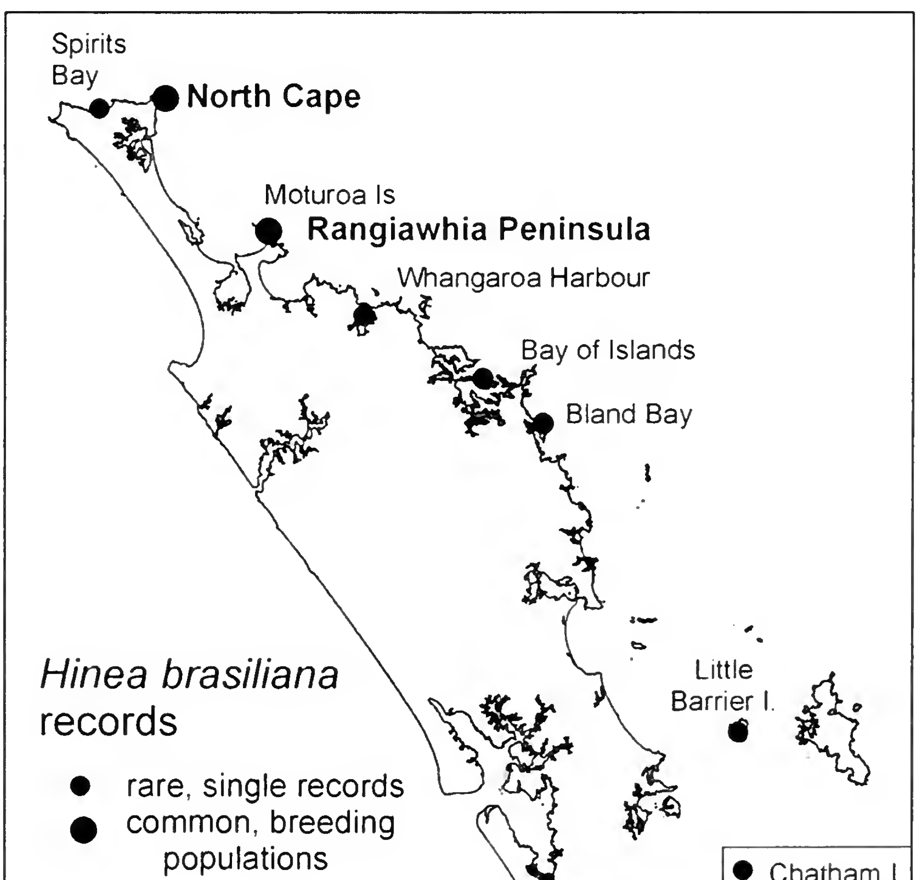

Fig. 3 Localities where *Hinea brasiliana* has been recorded from northern New Zealand.

North Cape locality

The North Cape locality is among high tidal cobbles near the top of the boulder beach that faces north extending from North Cape Island westwards towards Kerr Cliffs. Access is difficult. By land (as we did in 1967) now requires a Department of Conservation permit to pass through North Cape Scientific reserve and clamber down the cliffs. By sea (as we did in 1983), the easiest landing is on the often sheltered boulder beach on the south side of North Cape Island. The easiest and most expensive method is by helicopter (as was done in 2009).

Conclusions

Hinea brasiliana lives in Powell's Aupourian and Kermadecian biogeographical provinces and its regional distribution is clearly warm subtropical Southwest Pacific. One specimen has been recorded from Powell's Moriorian (Chatham Island) province, but there is no evidence that this species is living and breeding there today. It would appear that the species has two thriving populations along the coast of northeast Northland – one on the Moturoa Islands and adjacent tip of Rangiawhia Peninsula and the other at North Cape. The Moturoa-Rangiawhia population has not been reported upon for 34 years but we assume that it is still surviving. Attempts by Heather Smith to reach the Rangiawhia locality in Dec 2009 were thwarted by unfriendly land owners. Both the North Cape and Moturoa-Rangiawhia localities are on the ends of peninsulas that project into the path of eddies of the warm East Auckland Current and this probably makes them more suitable for this warmth-loving gastropod to survive and breed. At the Moturoa Islands for example there are also thriving colonies of the warm-water vermetid gastropod *Novastoa* (Grace and Puch, 1977) which only occurs at a few localities exposed to the warm eddies along the Northland east coast.

We speculate that the rare records early last century from Whangaroa, Bay of Islands, Bland Bay, Little Barrier I. and even Chatham I. were of specimens that were dispersed as larva by the East Auckland Current and had successfully colonised these downcurrent places but had been unable to establish sustainable breeding populations.

Acknowledgments

We thank Abi Loughnan for looking for and collecting three specimens from the locality described to her by BWH in 2009. We acknowledge the help of Fred Brook, Bruce Marshall, Peter Poortman and Heather Smith in providing information of *Hinea brasiliana* specimens in the collections in their care.

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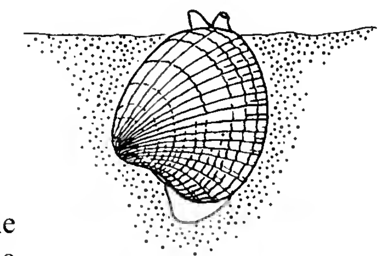
HAURAKI MARINE PARK PROFILES IN BRIEF

Margaret S Morley

This information was prepared to a brief from the New Zealand Herald for 80 words per section regarding the Hauraki Marine Park supplements (published March 1, 3, and 4 2010).

Whangateau Cockles (information Dr Roger Grace)



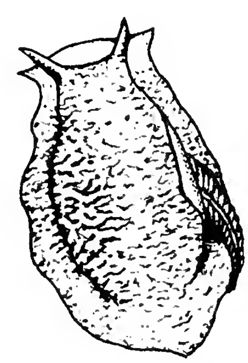
Locals first caught the malodorous whiffs of trouble in January 2009. The vast intertidal sand flats of Whangateau Harbour were home to some 360 million cockles, over 80% were dying, their empty shells lying thick on the surface.

The hot summer sun during low spring tides around midday caused the cockles to overheat. In this weakened state two organisms, a parasite and a bacterium quickly multiplied causing the cockle deaths.

Urgent closure of the beds was needed to allow the survivors to recover. However, legal processes prevented the Ministry of Fisheries closing the beds before February 2010, too late for the peak holiday harvesting. The concerned Whangateau Harbourcare Group consulted with the Ministry, Auckland Regional Authority and Rodney District Council who all supported an immediate voluntary ban. The Group put up 40 signs around the harbour. Although locals appreciate the seriousness of the threat to future harvesting and respect the ban, day visitors often selfishly demand their right to collect. Some signs have even been vandalised.

The cockles need time out to recover, please respect the voluntary ban. The Ministry's three year ban will hopefully be in place by February 2010 with options for extension.

Grey side-gilled sea slug *Pleurobranchaea maculata*



There was much publicity when dogs started dying in the Hauraki Gulf in July 2009.

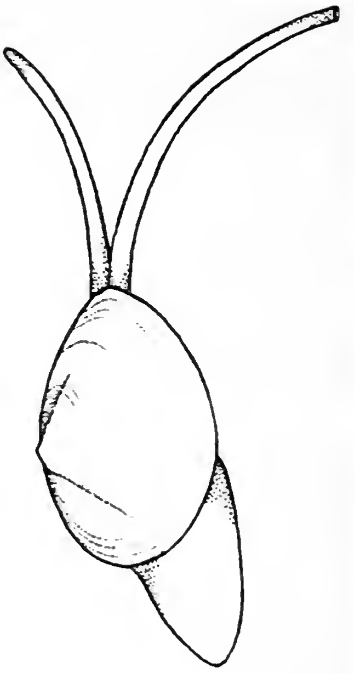
A grey side-gilled sea slug in dog vomit provided a clue. Auckland Regional Council sent specimens to Cawthron Institute, Nelson to identify the poison. It was tetrodotoxin (ttx), which paralyses respiratory muscles. Eight dogs have died, more vomited and recovered with prompt treatment.

Ttx is present in Japanese and Pacific puffer fish, but this is the first time it has been identified in New Zealand. A sea slug collected in 2007 by the Auckland Museum tested positive for ttx. This sobering thought means ttx is now present in New Zealand and is not just a one-off event . Cawthron found that spawn and larva of sea slugs put in tanks also tested positive, thus passing the potential for ttx to the next generation. Ttx was also found in a specimen from Nelson.

Auckland Regional Council has put up small notices on affected beaches. The poison has to be ingested but a small amount can be lethal, dogs have died within an hour of eating a sea slug. The toxin is present not only internally but also on the slug surface so if handled, could be ingested with food. All parents know 2-3 year olds put everything in their mouth so watch your toddler on all beaches and wash everyone's hands before your picnic.

Powell Survey

Hayward, B.W, et al. 1997 Faunal changes in Waitemata Harbour sediments, 1930s-1990. Journal Royal Society of New Zealand 27; 1-20.



In 1997 a team of scientists from Auckland War Memorial Museum led by Dr Bruce Hayward published a dredge survey of the Waitemata Harbour to compare with a similar one done in the 1930s by Dr Powell. The main species sieved, identified and counted were molluscs, (shellfish) and echinoderms e.g. sea stars.

The principal changes were 14 common marine snails e.g. olive shell, had disappeared or become rare; reduction of previously abundant turret shells in the Rangitoto channel; and a bed of large horse mussels living north-east of North Head. Three exotic bivalves had arrived since the 1930s, a file shell, *Theora lubrica,* a 7 mm, fragile shell, and the Asian mussel. The effects of introductions are difficult to predict, but are not entirely negative e.g. *Theora lubrica* provides a major food source for fish and ducks are fond of Asian mussels.

The exact causes of these changes are not well understood. Some may be natural, but many are attributable to human activities associated with New Zealand's largest city, these include tributyl tin poisoning (previously in antifouling paint), sewage outfalls, increased sediment, fresh water run-off, pollutants, ballast water and dredging.

If a third survey was done today it would also require years of study and would, no doubt, reveal further changes.

Omaru Creek, Tamaki Estuary siltation pond

(Information Colin Percy- Tamaki Estuary Protection Society and Chris Barfoot - Tamaki Estuary Steering Committee).

The health of the Hauraki Gulf depends on its many parts. The state of each creek that runs to the sea may either enhance or pollute.

Omaru Creek was seriously polluted, it drains to the Tamaki Estuary from its catchment in Glen Innes. The silt was contaminated with heavy metals, which stressed cockles and pipi reducing their adult size and ability to reproduce. Since bivalves improve water quality as they filter for food, the health of estuary is impaired downstream.

Four years ago, to reduce these problems, Auckland City Council created a large settlement pond while a grid retains larger pieces of rubbish. The council removes rubbish and water weed. Birds enjoy the pond while the creek today runs clear to the estuary. Long term, contaminated silt will build up and need to be removed from the pond then responsibly disposed of on land.

Wai o taiki walkway meanders from the pond along the estuary to Tahuna Torea sand spit. Walkers are rewarded with attractive views enhanced by many planted trees and flax. The next stage will be planting along the banks of the creek further improving water quality.

Wakaaranga Creek mangroves. (information Morag McDonald, resident 33 years).

When the first houses at the head of Wakaaranga Creek, Tamaki Estuary, were built in 1977, residents enjoyed a sandy beach margined with native grasses. Pied stilts, oyster catchers and herons fed on the open flats.

In the early 1980s, property developers Broadlands re-contoured the grassy slope on the northern side of the creek for a subdivision, causing a massive silt run-off into the creek. The changed habitat from sand to nutritious mud triggered a spread of mangroves across the bay. The mangroves in turn trapped more silt thus drying out the margins and causing the sea to retreat. Gradually, invasive weeds such as blackberry, gorse, agapanthus and convolvulus, ousted the grasses cutting off views from the walkway and reducing recreational opportunities. The pied stilts, oyster catchers and heron seek food elsewhere.

Although we should expect natural changes to beaches over time, this appears to be a result of ill-considered human activity lacking in environmental controls.

Pacific oyster *Crassostrea gigas*

Of all introduced shellfish the Pacific oyster is the most visible and has the most serious negative effects. It arrived in New Zealand about 1970, possibly on Auckland Harbour bridge extensions towed from Japan. It found the local conditions greatly to its liking and has extensively colonised the more sheltered shores, especially the upper Waitemata Harbour e.g. Te Atatu and Pollen Island. Very large specimens thrive in Orakei Basin. It is present throughout the Hauraki Gulf Marine Park.

In high density populations the oysters pack together and grow vertically, presenting lethally sharp surfaces for bare feet or swimmers. Dead shells form drifts at high tide providing hard substrate across the beach for the attachment of future generations of oysters.

On the plus side, Pacific oysters are used for commercial farming because they grow rapidly to marketable size (75 mm) in 18 months.

Pine Harbour Marina dredgings

(Information. Alan La Roche, Howick Historical Society).

In 1989, developers of a marina and residential area at Beachlands ironically changed the name Green Bay to Pine Harbour. The partly enclosed, shallow bay constantly needs dredging to keep the entry channel deep enough for boats. The very fine silt derived from local silt and sandstone is contaminated with heavy metals. 3000 m^3 of material has been dredged annually since establishment of the marina. It has been dumped by Coastal Resources (Kaipara Excavators) using a barge on the outer side of Motukaraka (Flat Island). Over the years the silt has built up smothering the beach and choking intertidal reefs to the detriment of marine life. Cockle beds have disappeared.

Resource consent for the dumping ran out in 2009. Pine Harbour management succeeded in deferring the hearing until April, 2010 and obtaining an extension to continue dredging, citing the need to keep the marina open during the summer.

Recent dumping (December 2009) has resulted in ankle deep silt covering sandy beaches, not only around Beachlands but fouling Cockle Bay, Mellons Bay and Howick beach.

Since Whitford landfill would welcome dredged material from Pine Harbour, for the sake of local beaches and the wider gulf, this must be the environmental choice for the future.

LIVING FOSSILS

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When one sees the phrase 'living fossils' the first one's that come to our minds are the New Zealand Tuatara lizard of the Sphenodontidae and the fish Latimeria of East African waters of the Coelacanthidae. Both of them evolved from ancestors circ. 200 million years ago (mya). As our dealings are with Mollusks, I would like to mention 3 families which are perhaps amongst the most interesting of the Phylum and have a more ancient lineage. However firstly it is important to clarify what we mean by this term. Darwin was the first to coin it and we can use a simple definition: "the recent members of an extinct group of organisms". Some Malacologists prefer: "those that have persisted for long intervals of time with little evolutionary change, and that are primitive and archaic in comparison with living taxa of the same class or phylum". Others like Stanley think this label should be dropped altogether. However we will accept the simple definition.

The first family worthy of mention among the Bivalves is the Trigoniidae whose ancestors evolved in the Ordivician circ. 450mya. Only 2 genuses of this family survived the Cretaceous mass extinction circ. 65mya. In the Cenozoic Era of these two the genus *Eotrigonia* is now extinct. The genus *Neotrigonia* is the only one still extant and it is found in Australia and includes only 5 species, each of which occupies a segment of the ring of shallow seas that encircle the continent. They have bizarre shell shapes with unusual profiles of huge interlocking teeth, and unique ridges or rows of knobs on the outer surface. They also have a highly muscular foot that enables them to burrow in sand more rapidly than other clams which inhabit shifting sands, and in addition have a distinctive heel facilitating leaping (like some cockles). These 2 characteristics and their agility have probably kept them one step ahead of their predators, and natural selection favored their survival. I am proud to mention that I had 2 specimens of *Trigonia bednalli* in my shell collection, which I got from friends in Australia.

The ancestors of the second family Neopolinidae evolved in the Cambrian cinc.500 mya. and of them in the present over 20 species have been identified and described. In 1952 10 living specimens of *Neopolina galathea* were discovered while trawling off the coast of Costa Rica at a depth of 3590 m. It was considered an unusual discovery, but later many more specimens were found at depths of up to 6000 meters, which accounts for them being undetected before. It was discovered that some of the earlier finds classified in this family were formerly identified as Chitons or limpets, but a new class was established and they now belong to Monoplacophora. They are found worldwide in the major oceans after being considered extinct since the Devonian circ.400 mya. They resemble Limpets in outer appearance and Chitons in several characteristics, but are different having a nacreous shell structure, a cap shaped protoconch and serial multiplications of several organ systems. Extant species feed on detritus in the cold waters in which they are found, and certain species have symbiotic bacteria in the epidermis of their mantle. It is possibly considered as an archaic mollusk, which may have lead to the evolution of Scaphopods, Bivalves, Gastropods and Cephalopods. They are even found off Antarctica and in the Red Sea as well.

Now we come to the most fascinating of our living fossils: the Genus Nautilus. The earliest Nautiloids evolved in the Cambrian, the first period of the Paleozoic era. They have thick shells for protection and their rears are closed off with calcareous partitioned chambers of liquid filled space. They developed a method of replacing this liquid with gas. In the partition between the chambers is a perforation permitting the passage of a porous tube called the siphuncle that includes blood vessels, nerves and other tissues. It joins the liquid filled chambers with the anterior living chamber.

The liquid is removed by osmosis: if the salt content of the liquid is lower than that of the animal's blood, the osmotic gradient causes the liquid to flow through the blood into the body, leaving behind a gas filled space. The role of the siphuncle is to control the gas and liquid content of the chambers. This creates a buoyancy organ, enabling them to hover weightlessly above the sea bottom and swoop down on their prey. They are jet propelled predators, catching prey with their tentacles and biting off chunks of flesh with a parrot-like beak. The shell shapes in former times were either straight or coiled (like snail shells), some reaching a few meters in size were recorded. The gas is at very low pressure and thus has an implosion depth, at which the greater pressure of the sea could crush the shell. So Nautiloids could only submerge down to about 600 meters, but usually most probably lived up to about 300 meters in comparatively shallower depths. The shell system has a very slow growth rate and it can take up to 20 years for the animal to reach full adult size.

During the Early Paleozoic fishes evolved, but mainly in fresh water lakes, ponds and streams. By the Devonian, however, they had invaded the sea and evolved true jaws. They at first attacked young Nautiloids, and slow growth became a major liability. The Nautiloids dwindled as fish proliferated. New species called Ammonites evolved from them and produced a vast number of tiny eggs, whereas the Nautiloids produced very few which took many months before they hatched. Thus the Ammonites through their numerous young that floated in the plankton, could be carried in the currents to widely separated parts of the globe. By the end of the Devonian they radiated explosively into many hundreds of new species. 80 genera existed then, but they were later annihilated by successive mass extinctions. They became common again in the Mesozoic era (the Age of Dinosaurs) with over 400 genera in the Triassic circ.220 mya. Despite a mass extinction at the end of the Triassic when only 2 genera survived, they radiated again in the Jurassic. By the early Cretaceous they were amongst the most common creatures of the sea. The subsequent mass extinction at the end of the Cretaceous (referred to as the KT extinction cinc.65 mya.) annihilated them, after a 300 million year reign. Near the end of their reign they evolved other shell shapes and sizes, (becoming giants or very small - a few cm.), but to no avail.

The cardinal question is why did the Nautiloids survive the KT extinction? According to P.T.Ward one of the reasons is that the Nautilus eggs seem to be laid and kept at great depths (100-300 meters) during the year it takes them to develop.

The KT catastrophe killed off all the juvenile and adult Ammonites and Nautiloids as well, except for their slowly developing eggs, preserved at a great depth. Only 1 genus Nautilus survived till the present, with only 5 species.

But are these the only living fossils of mollusks? I have searched my available literature and would like to present a list of the extant common families whose ancestors can be traced further back than 150 mya. I have not added the Cretaceous Period as it borders on the Cenozoic era, when most of the present extant species of mollusks evolved, and many of them trace the first appearance of their ancestors back to it. My list has been limited to families well known to most shell collectors.

Mesozoic Era:	**Jurassic.**	Aporrhaidae, Epitoniidae, Ringiculidae, Cylichnidae, Physidae, Retusidae, Ellobiidae, Siphonariidae.
		Arcidae, Anomiidae, Tellinidae, Arcticidae, Thraciidae, Teuthidae, Sepiidae.
	Triassic.	Scissurellidae, Fissurellidae, Neritidae, Strombidae, Naticidae, Architectonicidae.
		Mytilidae, Pteriidae, Limidae, Ostreidae, Gryphaeidae, Spondylidae.
Paleozoic Era:	**Carboniferous.**	Acteonidae, Pinnidae.
	Devonian.	Solemyidae, Nuculanidae, Pectinidae, Cardiidae.
	Ordivician.	Trochidae, Buccinidae, Scaphopoda
	Cambrian.	Pleurotomariidae, Chitons.

It is interesting to compare the evolutionary history of the Brachiopods (Lamp shells) and Mollusks which have similar calcareous shells and were classified as the same phylum till the early 20th Century, but are now in separate phylums.

The Brachiopods also evolved in the Cambrian and radiated in the Paleozoic to reach over 10,000 species, forming one of the most common and characteristic of the era in the warm shallow seas. For 200 million years they were one of the optimum successful groups of the seas. The Permian mass extinction decimated their numbers and many thousands of species died; the heyday of Brachiopods was over, never to return. They were forced into caves and deep waters or the edge of the sea. Some survivors became poisonous and unappetizing to predators. They retreated to inhospitable habitats and even quit the tropics entirely, mainly for deep and cold waters and only a few hundred species are still extant.

After the Permian extinction innumerous habitats were vacant for exploitation, and the Mollusks quickly filled many of them and radiated into new species, replacing the Brachiopods. But then followed the Mesozoic Marine Revolution: shell breaking and other predators arrived, among them Mollusk Neogastropods like Oyster Drills, Cones and Tritons but also Crabs, Lobsters, Rays and Skates. In order to survive many of the Bivalves took to the depths of the sea and brackish backwaters or estuaries and the high intertidal zone – places of extreme temperatures or sudden changes of salinity. They learned to live where the predators could not. They also invaded terrestrial habitats very successfully. Worthy of note among the clams from the middle of the Paleozoic are the Scallops (Pectinidae) that have survived. The secret of their success was they can clap their valves and swim away from their predators.

Thus the Mollusks now stand foremost among invertebrates, if one considers variety of shell form, diversification of structure and success of adaptation to changing conditions. They currently comprise the second most prolific phylum of fauna with 130,000 named extant species and 70,000 described fossil species.

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THE BLUE MUSSEL, *MYTILUS GALLOPROVINCIALIS PLANULATUS*, EXPANDS ITS RANGE AROUND AUCKLAND

Margaret S Morley and Bruce W Hayward

Recently established populations of the blue mussel, *Mytilus galloprovincialis planulatus*, are reported from the inner Hauraki Gulf around Auckland.

Name Changes

Recent research on this species has resulted in several short-lived name changes, and despite this the taxonomy may still be unstable (de Cook, 2010). It has been known previously as *Mytilus edulis, M. planulatus, M. aoteanus* and *M. galloprovincialis.*

Simon Crowe (1910) records *M. galloprovincialis planulatus* as a non-introduced species present in Tasmania and southern areas of Australia.
AK numbers refer to lots in the Auckland War Memorial Museum collections.

New Zealand Geographic Range

The geographic range of *Mytilus g. planulatus* in the intertidal zone is throughout New Zealand, including the northern Aupourian province (Spencer et al. 2009). They are common in the south, but rare over the northern half of the North Island (Powell, 1979). Dense beds occur in some southern localities, e.g., Marlborough Sounds (de Cook 2010, p. 485). In Fiordland they live near high tide level on the rock walls of most fiords, together with *Limnoperna pulex* and *Aulacomya maoriana* (Ryan and Paulin, 1998). Bruce Marshall (1999) recorded them live in the Wellington area from 1960 to the present.

A dead specimen from Owenga, Chatham Island, collected in 1933, is in the Auckland Museum. Very large specimens up to 150 mm in length have been recorded (de Cook, 2010, p. 485) but no location is given. Northern specimens tend to be smaller than southern ones. When checking the Auckland Museum collections, it was interesting to note that pale golden specimens of *M. g. planulatus* occur in North Canterbury, Dunedin and Marfells Beach, south Otago (AK98956).

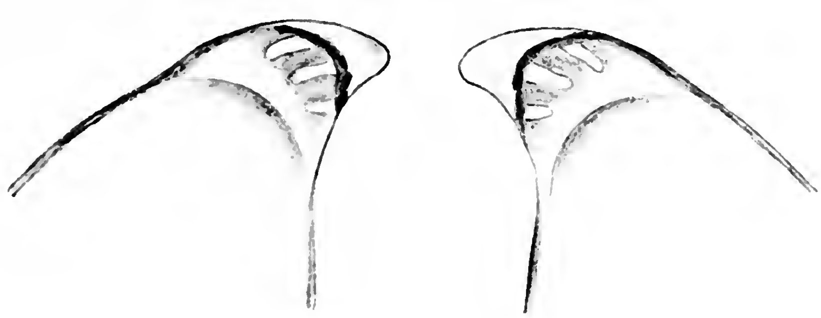

Fig. 1. Hinge teeth of *Mytilus galloprovincialis planulatus*

Identification

The common name, blue mussel, distinguishes it from the green-lipped mussel, *Perna canaliculus*. However both species can be dark to almost black and sometimes occur in the same locations so it is easy to confuse them. *M. g. planulatus* lives on mid-tide rocks while *P. canaliculus* is more often found at low tide and down to 50 m depth (Powell 1979). Sunlight filtering through water can reflect deceptively blue colour from *P. canaliculus* (pers. obs.). Both have similar, variable shapes, but *M. g. planulatus* has a narrower beak, is broader and more inflated than *P. canaliculus.* The most positive feature to confirm identification is the small teeth in the hinge at the anterior end of *M. g. planulatus* (Fig. 1), which are not present in *P. canaliculus* (Fig. 2). However the teeth are sometimes eroded off in beach worn specimens.

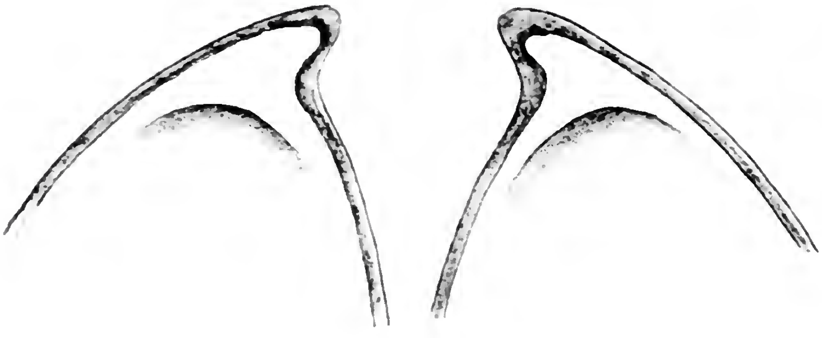

Fig. 2. Hinge details *Perna canaliculus.*

Distribution in the north of the North Island

The presence or absence of *M. g. planulatus* on known dates at various locations around northern New Zealand are summarised in Figs 3 and 4 and the appendix.

The earliest records of *M. g. planulatus* from northern New Zealand in the Auckland Museum are of specimens from small, localised populations at Great Barrier and Waiheke Islands collected in 1932 (AK119186, 14882). Single valves were found washed up at Oneroa, Waiheke Island in 1982 and 1986 (Morley collection) but have not been found there over frequent visits since (pers. obs.).

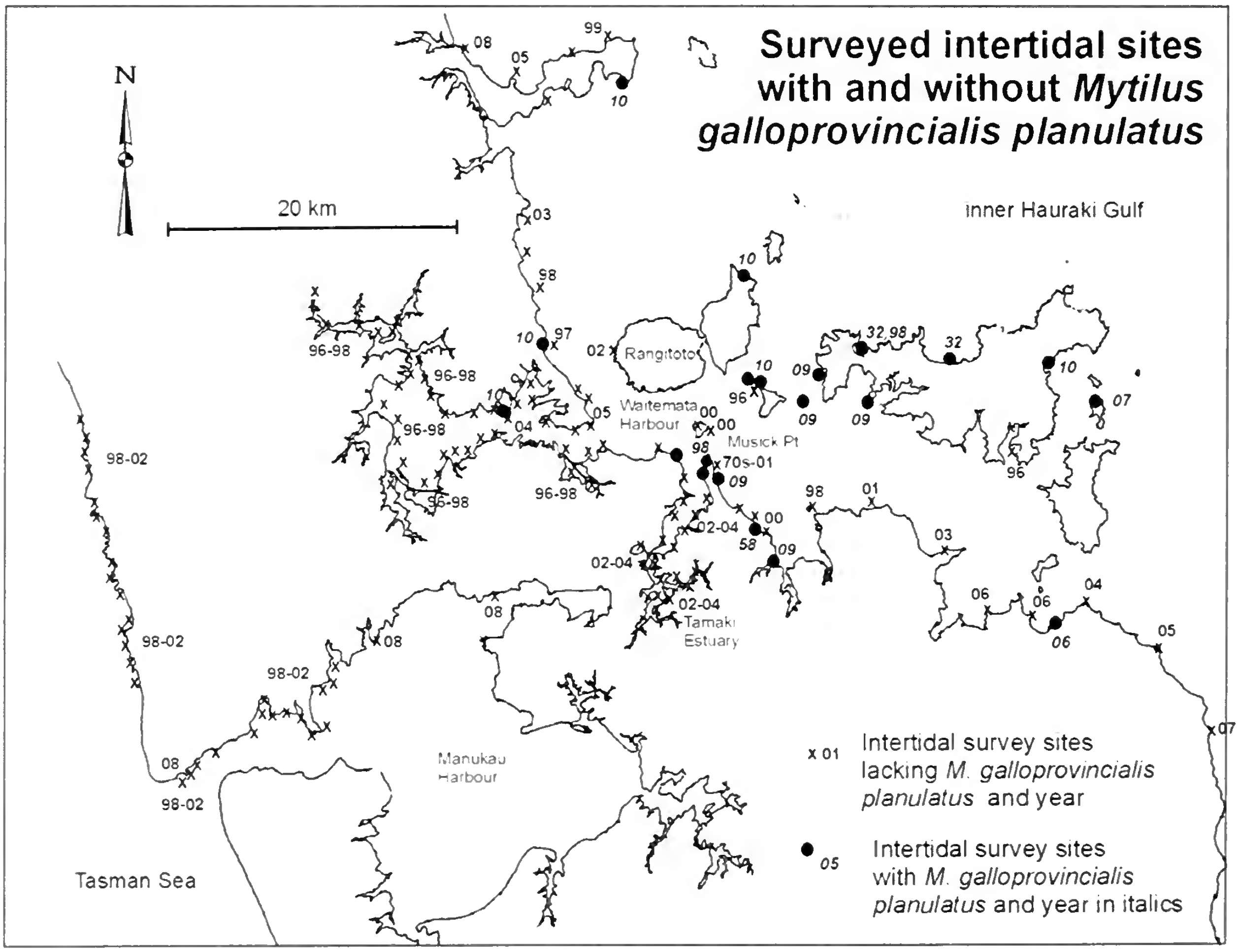

Fig. 3. Distribution of the Blue mussel, *Mytilus g. planulatus* around the Auckland region

Between 1970 and the 1990s, specimens were plentiful in Kaiarara Bay, Fitzroy Harbour, Great Barrier Island when they provided a welcome addition to the Morley family diet! We found them to be locally common in the Bay of Islands in the 1990s (AK731220; Morley and Hayward, 1999). This species has been present in the northern Hauraki Gulf for some time since rare dead specimens were dredged up from 40 m from off Pakiri, in replenishment sand put on Mission Bay, Auckland in the 1990s (Morley et. al.1996). Rare live specimens were present at Cudlip Point, Mahurangi in 2005, these had changed in 2009 to higher numbers over a wider area (pers. obs.). A single, mature valve from Tokerau on the north-east coast of Northland collected in March 2010 appears to be the most northern record.

Our earliest known record from the Waitemata Harbour is a dead specimen found at Howick Beach in 1958 (Arthur White collection). In 1998 and 2001, single live specimens were found in high tide rock pools at Musick Point (Morley collection). Subsequently, occasional live specimens in the same area were noted by Chris Horne in 2005 (AK116847). More recently, specimens were found living at Eastern Beach in August 2009.

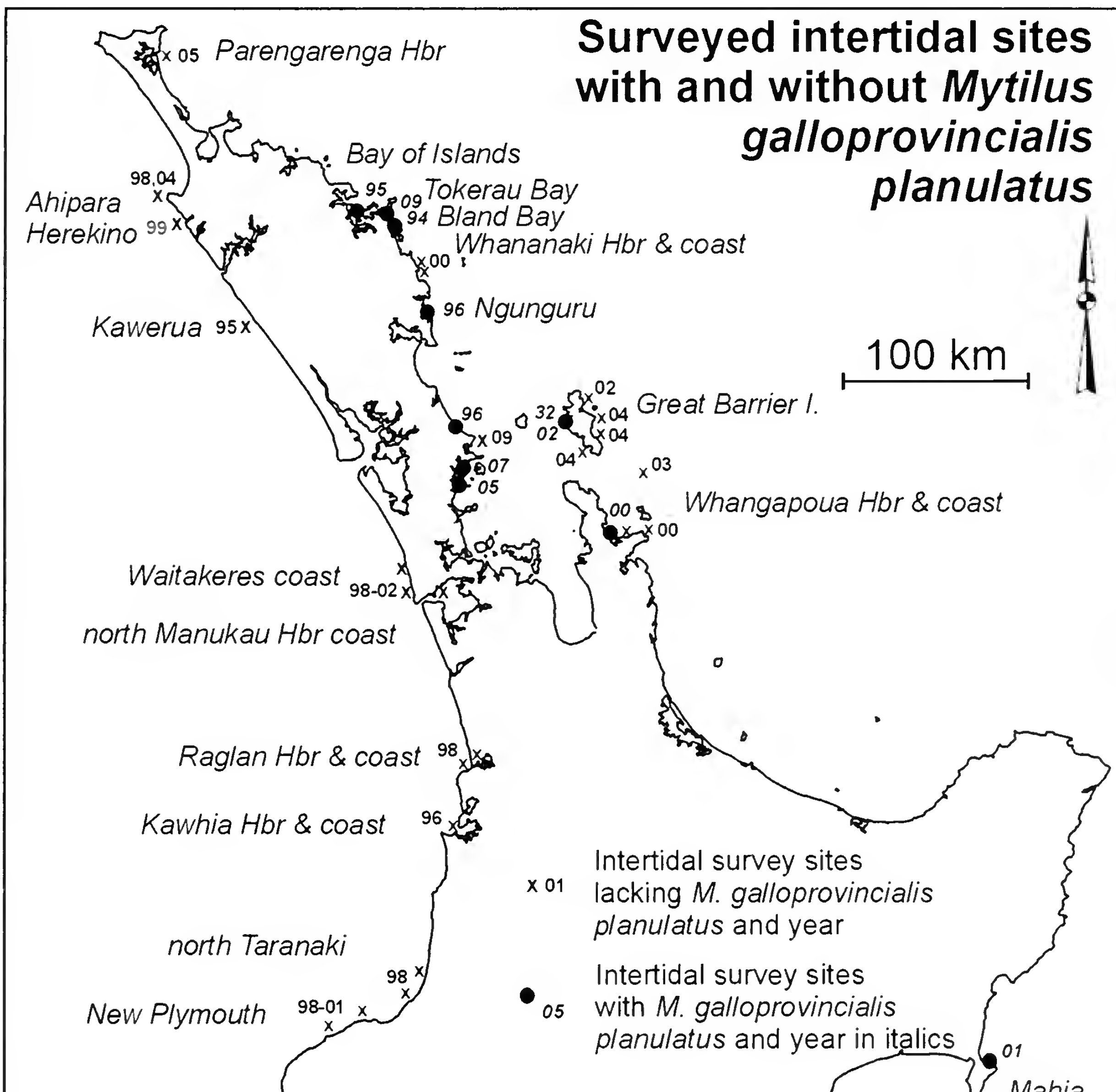

Fig. 4. Distribution of *Mytilus galloprovincialis planulatus* in the inner Hauraki Gulf.

In March 2009 and June 2010 live specimens were found attached to mid-tide rocks on the northern coast of Motuihe Island; in August 2009 low numbers were living at Man o' War Bay, east end of Waiheke Island and on Motukaha Island on the west coast of Waiheke. A few live specimens of *M. g. planulatus* were found by the authors at Little Shoal Bay, Waitemata Harbour in March 2010. Occasional live intertidal specimens were found at Waikulabubu Beach, north-east coast of Motutapu Island, Waitemata Harbour in February 2010 (pers. obs.).

The most dramatic occurrence noted by the authors has been the dense beds on intertidal rocks at Kennedy Point, south coast of Waiheke Island, Waitemata Harbour in March 2009. These were fully adult indicating the beds have been present for at least two years.

Localities where *M. galloprovincialis planulatus* was not found

M. g. planulatus was not found in the Waitemata Harbour during shoreline searches in the 1990s (Hayward et al., 1999a), nor was it present at the following locations: the Waitakere coast during 30 field days of intertidal searches between 1998 and 2002 (Hayward and Morley, 2004); Raglan (Hayward et. al. 2002); Kawhia (Morley et al., 1997); Taranaki (Hayward et. al. 1999b); Kawerua (Hayward et. al., 1995); Ahipara (Hayward et. al., 2004); New Plymouth (Hayward and Morle.y 2002); Beachlands (Morley et. al.1998); Parengarenga Harbour (Hayward et. al., 2001) and many far north beaches from Taupiri to Cape Maria van Dieman and Spirits Bay during an extensive trip by Heather Smith and MSM (Morley and Smith, 2005).

Discussion

In the last two to five years *M. g. planulatus* has colonised new areas around Auckland, such as Kennedy Point, Waiheke, and Eastern Beach and Musick Point, near the entrance to Tamaki Estuary, where it is becoming common on intertidal rock platforms. Have pre-existing populations to the north (e.g., Bay of Islands and Great Barrier Island) spread south, becoming more common, or are the new records due to spread from the south? The latter seems unlikely as this dispersal would be against the south flowing current and there are no common populations of *M. g. planulatus* along the east coast of the North Island, south of the Waitemata Harbour. It is possible however that they have been transported north attached to boats.

It could be expected that such a predominately southern species would prefer cooler water, but although the surface water on the west coast of the North Island is three degrees cooler than that on the east coast (Adams, 1994), no *M. g. planulatus* have been recorded from the west coast from New Plymouth to Ahipara (Fig. 4). The Durville Current flows north along the west coast variably as far as New Plymouth, so has the potential to carry larvae from the Wellington area, where *M. g. planulatus* is the dominant mussel, but this has not occurred. Further north currents are weak and variable and have the potential to transport larvae both north and south along the west coast of the northern North Island (Sutton, 2010).

If any members have additional data in their collections or from observations in the north or the west coast of the North Island to clarify the spread of *M. g. planulatus*, please contact Margaret phone (09) 5768323 or email mmorley@aucklandmuseum.com

Acknowledgements

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Appendix showing northern spread of *Mytilus galloprovincialis planulatus*. n = nil found, d = dead, r = rare, o = occasional, c = common, l = live

	1925	1932	1958	1970	1982	1986	1990	1994	1995	1996	1998	1999	2001	2002	2004	2005	2006	2007	2009	2010
Gt. Barrier Island		l		o	o	o	o	o	o	o	o	o		o	o					
Bay of Islands									l	l	o	o								
Bland Bay								l												
Pakiri										d										o
Ngunguru										d										
Far Northland beaches																n				
Tokerau																				d
Ahipara															n					
Kawerua									n											
Raglan													n							
Kawhia										n										
Taranaki												n								
Whangapoua, Coromanel													d							
Whananaki														d						
Cudlip Point, Mahurangi																r			o	
Martins Bay, Warkworth																		d		
Scandretts Point, Warkworth																		d		
Shakespear B., Whangaparaoa																				o
Rotoroa Island, Hauraki Gulf																		d		
Kennedy Bay, Waiheke																				c
Oneroa, Waiheke		l			d	d					r					n			n	
Onetangi, Waiheke		d																		
Motukaha Island, Waiheke																				o
Man o War Bay, Waiheke																				o
Te Matuku, Waiheke										d										
Crusoe Island, off Waiheke																			o	
Waikulabubu, Motuihe																				o
Takapuna																				d
Eastern Beach																			o	c
Motuihe Island										n									o	
Musick Point, Tamaki Estuary						n	n	n	n	n	r		r	r		o			o	o
Karaka Bay, Tamaki Estuary																				o
Howick			d																	d
Mangemangeroa																			o	
Kawakawa Bay																	d			
Beachlands											n									
Little Shoal Bay											n	n								o
Waitemata Harbour								n	n	n	n	n								o
Mahia													d							
Castlepoint													o							
Wairarapa coast													l							
Waitakere coast											n	n	n	n						
New Plymouth														n						
Auckland islands	l	l																		
Campbell Island		l																		
Chatham Island		d																		

Appendix showing northern spread of *Mytilus galloprovincialis planulatus*. n = nil found, d = dead, r = rare, o = occasional, c = common, l = live

THE EARTHQUAKE STRIKES CHRISTCHURCH

Colleen Patterson

I lived in Orere until I was 12, living on the corner of Deery Road leading down to Ashby's Beach (now Tapapakanga Regional Park), before moving over to Kawakawa Bay. Mum continued living there until she died 10 years ago - so that meant lots of visits and holidays at the beach during my adult life.

I was always being told to remove the smelly shells form under my bed! For my 12th birthday mum and dad gave me a second hand oak framed glass cabinet with glass shelving - it cost 2 pounds and measured 500cm wide x 300cm deep x 1750cm high.

When I was 25 and buying my own house one of my brothers brought my cabinet to me in his truck. I already had my shells. Being in Rotorua we had quite a few shakes and tremors every year and I always knew something was going on because the shells rattled the glass shelves.

Fourteen years later I remarried and moved to Reporoa, complete with shell cabinet and shells that kept rattling. Whilst living there mum read an article in the NZ Herald about shells at Mission Bay, sent it to me, and I subsequently joined the Auckland Shell Club.

Now I had the opportunity to see, learn about, and buy shells. I acquired Jim's old glass fronted stereo cabinet. Ten years later we were off to Tokoroa for two years (through Jim's work) and my shells rattled on the glass shelving over there as well. Whilst there, for my 50th birthday Jim built a lovely big wooden cabinet with 24 slim drawers with individually fitted dividers of various sizes for guess what - More shells!

Then back to Rotorua for ten years where the shells still rattled. I got a cupboard and a bookcase. Jim retired and we moved to Christchurch. Here I have got a whole small room allocated to my shells, a bench and more drawers.

Just before 4.36am on Saturday 5th September 2010 we both woke - "what's that?" as there was a loud noise coming straight towards us it seemed. Then we started to "rock and roll". I yelled "my shell cabinet". I leapt out of bed, catching the cabinet as it headed towards me. I leant on an angle towards the cabinet, holding it at the top with my arms straightened out - it took all of my strength (and I'm a reasonably strong person). The quake just kept coming. The two door cupboard beside me was bouncing in and out. The drawers in the wooden cabinet Jim built went inwards, other drawers came outwards but not completely out. I had three tall heavy wires inserted into a wooden base and upon the wires threaded 50 or so various sized sea eggs collected over the years at Kawakawa Bay - unfortunately about two thirds of them were destroyed in the earthquake. On the bench I had set out my neritidae family as I'd been spending time on them - they didn't move and survived the quake intact!

Around 5.30am I had the chance to prop the cabinet up with a cane chair, padded with two large outdoor chair squabs. With many strong shakes continuing it took me several hours to stop thinking "my shells!". It wasn't until late Sunday I began to relax with only smaller shakes and shudders occurring. The power was reinstated by 1.00pm on Sunday.

We have both been very lucky with no damage to the house or section. Initially it appeared that a lot of damage had occurred to contents but once we tided up we had very little breakage. Although we did lose a few pieces of Mum's old china.

By 6.00am on Saturday we sorted out another phone to plug directly into the phone connection and Michael rang to see if we were alright. I told him what I had done – his advice was that I was supposed to save myself not my shells! Apparently what Nadine said when he told her is unprintable!

First for me I went to Mitre 10 Mega here in Hornby. The oak cabinet is now attached for the first time in its life to the wall with earthquake brackets and whilst writing this we have had three reasonable shudders.

Now I know what I should do in the event of an earthquake – but for a shell lover my first thought was to my shells.

POIRIERIA

Auckland Shell Club

(Conchology Section, Auckland Museum Institute)

http://nz_seashells.tripod.com

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All correspondence regarding membership, change of address, distribution queries, back issues, etc should be addressed to the Secretary identified on our website
We also welcome contributions on suitable topics emailed to the Poirieria Editor identified on our website

Editorial

As I write, I am completing preparations for our annual recycling day (shell club members auction) - a good way to enhance collections without removing more specimens from their natural environment.

This has been a significant year for increased awareness of our total environment. There is no doubt we are well advanced into the reality of global warming, and the numerous adaptations all earthly life forms must make in order to survive. Stories of undersized malnourished polar bears swimming greater distances in an increasingly distressed and exhausted state in their search for food make uncomfortable reading. Increased Arctic sea temperatures do not make for an abundance of food, in fact the melting ice floes and diminishing coastal ice fields are effectively blocking the normal feeding and foraging ranges of polar bears and other Arctic dwellers. Comparable changes are also occurring in Antarctic seas.

For the first time I have been disconcerted to harvest runner bean seed pods at the end of autumn with the mature bean seeds already sprouting, and my pear tree has produced three crops of blossoms in less than a year.
On a Pacific Islands cruise this winter I visited many of our modestly sized Pacific neighbours. How vulnerable they are to a minor rise in sea level, or any seismic disturbances, or drought. Only a few days ago the island of Tuvalu was down to 60 litres of fresh water for a population of more than 300 residents, and was sent relief from New Zealand in the form of a desalination plant.

On a more positive note I recently saw an excellent TV documentary "*BBC Human Planet*" portraying the lives of people living harmoniously in a close marine environment, seldom, or never venturing onto land. One humble fisherman making a living in an area of significantly dwindling fish resources had developed a truly superhuman feat of hunting for fish. With the aid of deep controlled breathing and meditation he was able to slip over the side of his simple canoe, dive unaided, and literally sprint across the seafloor, chase and spear a fish, and return to the surface in a single sustained two and a half minutes breath. Survival of the fittest, undoubtedly.

With global warming a reality, I expect we may find more molluscan wanderers from tropical seas washed up around our coasts - an opportunity for Shell Club members to make new discoveries in the future.

I wish to dedicate this issue to the memory of the late, truly great, John Morton, who enlivened and educated the lives of so many people from all walks of life.

Your Editor,

Patricia Langford

October 2011

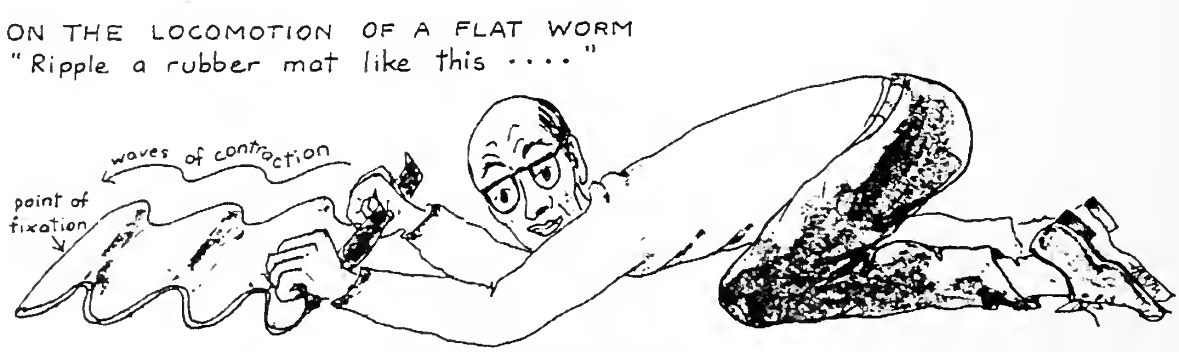
Obituary
Professor John Morton B.Sc., M.Sc., Ph.D., D.Sc., FRSNZ, QSO

By Margaret S. Morley

Members of the Conchology Section were saddened to learn of the death of John Morton, aged 87.
John passed away quietly at home on Sunday 6 March 2011 with his wife Pat, son Robbie and daughter Clare beside him. His funeral was held at St Mary's cathedral, Parnell where his coffin was covered with Struthiolaria shells as he had requested. The large number of people attending showed how widespread his influence has been.

John was Patron of the Shell Club for 27 years giving us annual lectures, often concluding one by enthusing on his next topic. These lectures were the most popular and inspiring of the year. Who could forget his dramatic use of his multipurpose gown or jacket to represent the molluscan mantle, or the gills that were drawn on the inside with white chalk?

On one occasion he laid face-down on the floor creating ripples with an old (rather dusty!) mat to show us how the wave of muscle contraction passed along a flatworm. At the time I was writing the newsletter and made a cartoon of this bit of drama. After it was printed I got cold feet and worried in case he was offended, but he took the trouble to phone me and say how much he enjoyed it! His motto was "A good teacher cannot stand on his dignity".
He certainly followed his own dictum with great exuberance. Everyone who knew John has their own special stories and anecdotes attesting to his delightful sense of humour.



John was founding Professor of Zoology at Auckland University where he inspired many students and other colleagues, including those who have since risen to be eminent scientists. Walter Cernohorsky tells of John returning from a Royal Society trip to the Solomons and giving him numerous Nassarius species to identify, saying "You should write a book on these, there is nowhere

to look them up". This was the impetus that started Walter publishing on this species (Cernohorsky 1972).
John was the author of numerous scientific papers and other illustrated books (see below).
A comprehensive account of Professor Morton's immense, academic achievements, including his publications, is documented by Brian Morton (2011). An important book on molluscs was written by John in 1958. Generations of students found this book so valuable that it went to nine editions. Following his research with Michael Miller on New Zealand marine intertidal fauna during the 1960s, their book, The New Zealand Sea Shore, (1968), provided a detailed reference. Although the names are well out of date, this is still widely used today.

In 1965 it was John who advocated Goat Island, Leigh as the site for the University Marine Research Laboratory. He was its first director. This location offered a variety of different habitats within a short distance.
New Zealand's first marine reserve at Goat Island was gazetted in 1975; it is now the most visited in New Zealand, with further development underway for a public interpretation centre.

For many years the Shell Club used to hold meetings in the Auckland Museum. Before one meeting, I discovered John preparing for his lecture by drawing "invisibly" on the blackboard. As I was greatly puzzled, he showed me his method of using black crayon for the outline which could be followed accurately at lightning speed during the lecture with coloured chalks. He was not at all fazed by the fact that the crayon could not be cleaned off again! He delighted in the fact that the outline of a clam he had drawn 20 years before could still be seen close up.

When Ngataringa Bay on the North Shore was threatened with reclamation in 1980, John led a series of public "beach" trips (Morley 1981). On one of these John was following a young boy wearing a hooded jacket. As the boy walked along, John steadily filled the hanging hood with mud crabs. To the delight of the watching group it began to rain, no doubt that boy has vivid memories of flipping his hood up!
We were all taken in by John's next trick which was to entice everyone in close to view the animals under a slab of rock, then, whack, he released it into the muddy water! This series was my own introduction to the fascination of beach life.

The Shell Club held its 50th anniversary in the Auckland Museum in 1980. John illustrated his lecture using two blackboards, drawing with great speed first on one, then the other. A young member had been appointed to rub out after him and at times had to run to keep up with the pace!

When the Marine Department at Auckland War Memorial Museum was threatened with closure in 1997, John gave an impassioned speech against closure and redundancies to a Trust Board meeting. He also gave a public lecture supporting the marine department, ironically, as he pointed out, at the Marine Rescue Centre!

When sand dredged from off Pakiri was used to replenish Mission Bay in 1996, John wrote a lyrical article in Poirieria on the dangers of using a finite resource (1996).
His other writings for the Poirieria Journal include two entitled Strombacea revisited (1997).
In 2005, John attended the Shell Club's 75th anniversary when he blew out the candles on the cake with Noel Gardner. He gave the Shell Club a complete set of all his numerous scientific papers.

John published his last book, "*Sea Shore Ecology of New Zealand and the Pacific*" in 2004. This was his major retirement project and for many years it seemed that no publisher would touch it, until our shell club came to the rescue with a contribution and successfully solicited sponsorship support for it from DoC. and local authorities to the tune of $40,000. The second condition to have

it published was that the taxonomy needed to be updated throughout - a demanding and time-consuming task allocated to another shell club member, Bruce Hayward.

John's expertise in Pacific shores developed from leading groups of Auckland University undergraduate students to Fiji between 1977 and 1983. He had also worked in Samoa, the Cook Islands, New Caledonia, Papua New Guinea, Hong Kong and British Columbia.

His drawing skills were legendary, he was able to capture the essence of an organism or shore zonation. He was the first to draw a map and illustrate a cross section of a shore. For this book he drew some molluscs from the Auckland Museum collections. His method was to boldly draw the draft in biro as he explained this means you really have to get the proportions right the first time!

John's interests spanned many disciplines. His passion for conservation and botanical expertise played a key role in saving Whirinaki forest and the west coast beech forests in the South Island from logging (Morton 1984).
Closer to his home in Castor Bay, Auckland, with his wife Pat, he founded the Centennial Park Bush Society to protect and enhance a local area. Society members continue to remove weeds, plant natives, maintain and develop walking tracks.
John was a devout Christian, becoming an honorary Canon of the Diocese of Auckland. He wrote three books on theology.

At John's funeral his daughter told of John dissecting dead animals on the kitchen chopping board and examining gut to see what fish had been eating.
His wife, Pat gave unfailing support in all his endeavours. As well as preparing meals, sometimes for big numbers at short notice, she did the accounts and gave him pocket money. Sometimes he had to ask for an advance! Sadly Pat passed away nine days after John.

John will be fondly remembered for his time and unique expertise so generously given to the Conchology Section. His inspiration lives on.

Thank you to members of the Shell Club who shared their memories.

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(A complete list of John Morton's books and papers is published in Brian Morton's obituary 2011).

John Edward Morton, 1923-2011

1952	PhD, Birkbeck College, London University
1952-60	Lecturer in Zoology Queen Mary College, London
1958	Vice-President Malacology Society of London
1959	DSc, London University1960-88 Professor of Zoology, Auckland University
1960-70	Head of Zoology Dept, Auckland University
1965	Leader of Royal Society Marine Expedition to Solomon Islands
1965-72	Chairman of Leigh Marine Laboratory committee
1968	Appointed Fellow of the Royal Society of New Zealand
1972	Appointed Honorary Fellow of Linnaean Society of London
1974-75	Leverhulme Professor of Biology, Hong Kong University
1970s	Elected member, Auckland Regional Council
1975	Initiator of Biological Conservation programmes for ARC
1975	Chairman, NZ Nature Conservation Council
1977	Visiting Professor of Marine Biology, Vancouver Island, Canada
1978 - 86	Member of the Executive of NZ Royal Forest & Bird Society
1980s	Leader of annual shore ecology field courses in Fiji
1986	QSO for contribution to NZ science & conservation
1987	Chairman, NZ Royal Forest & Bird Society
1997-1999	Member, Auckland Museum Institute Committee
1988-2010	Patron of Auckland Museum Conchology Section

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Oystering: Notes resulting from an April/2011 field-trip.

By Michael K. Eagle

A fossiling field trip to the Cretaceous sediments of Gittos Point, Hargraves Basin, Kaipara Harbour early April 2011 was marred by a large increase in settlement of the Pacific Oyster (Ostreidae, Crassostreinae: *Crassostrea gigas* (Thunberg, 1793)).
I last visited the locality with Glen Carter in October of 2001, and though spat had occasionally clumped themselves on foreshore wave-cut sandstone knolls and rills, the beach at that time was relatively unencumbered. My visit this time (at low tide) was most disappointing with large swathes of the oyster covering the tidal zone, most struggling to survive amidst a blanket of retained silt. Naturally this did not make for a clear and open appraisal of the Haumurian Stage outcrop, making fossiling nigh impossible.

Fig. 1. Gittos Point, Kaipara Harbour, looking from Cobble Beach across Hargraves Basin to Oneriri.

Since being deliberately released into this country, the exotic Pacific Oyster has competed for space with several others (*e.g.* Ostreidae, Ostreinae: *Saccostrea glomerata* (Gould, 1850); Ostreidae, Ostreinae: *Ostrea chilensis* Philippi in Kűster, 1844 (including forms now synonymised: *Ostrea lutaria* Hutton, 1873a; *O. virginica* (not of Gmelin, 1791) of Hutton, 1873a; *O. corrugata* Hutton, 1873b (not of Brocchi, 1814); *O. discoidea* (not of Gould) of Hutton, 1880; *O. edulis* (not of Linné, 1758) of Hutton, 1880; *O. angasi* (not of Sowerby), *O. hyotis* (not of Linné), and *O. reniformis* (not of Sowerby) of Suter, 1913c; *Ostrea tatei* Suter, 1913c (Suter's type is the Australian Eocene holotype of *O. hippopus* Tate, 1886, not of Lamarck); *O. sinuata* of Finlay, 1928b (not of Lamarck); *O. fococarens* Finlay, 1928b (new name for *O. corrugata* Hutton, preoccupied); *O. heffordi* Finlay, 1928b; *O. charlottae* Finlay, 1928b; *O. huttoni* Lamy, 1929 (new name for *O. corrugata* Hutton, preoccupied); *Tiostrea chilensis lutaria* Beu & Maxwell, 1990; and another exotic, brooding oyster, *O. stentina* Payraudeau, 1826 (Beu and Raine (2009)).
The Pacific Oyster has been particularly invasive in this country resulting in previously clear foreshore becoming encrusted with razor-sharp progeny settled one upon the other in the absence of a hard substrate. Serendipitous settlement sometimes creates minor biostromes not dissimilar in basic structure to the massive ones of the late Pliocene (Mangapanian Stage) *Crassostrea ingens* (Zittel, 1864) reefs in the Wilkies Shellbed, Wanganui Basin (*e.g.* Oyster Bluff on the Pipiriki Road, 5 kilometres north of Parakino).

Biostromes alter the foreshore deposition and environment of a locality over time, often causing coastal progradation by the sustained natural accumulation of sediment and shell.

Fig. 2. a. Crassostrea *virginica* tidal reef, South Carolina; b. American eastern oyster *Crassostrea virginica* (no scale implied).

The Kaipara Harbour (one of the largest in the world) has many aquaculture farms spread about its vast area, including an oyster farm not far from Gittos Point. Oysters have been enjoyed by humankind since hominids first colonized coastal margins. Readily accessible, easy to eat, their nutritional benefit and acquired taste enabled a ready market. The Romans are first credited with creating artificial oyster beds in the First Century B.C. developing them from the European native species *O. edulis* Linné, 1758.
Little was spoken or published about marine aquaculture or the possibility of it during Britain's Dark and Middle Ages when science was essentially repressed (*i.e.* by religious fervor). However, it was known even then (*i.e.* over 300 years ago in the 17th Century) that oysters spawned in the early Summer and that spat 'claved' to stones, old oyster shell, wood 'and such things' at the bottom of the sea, which at that time they called a 'cultch'.

The last 120 yrs has seen the demise of British and New Zealand native oysters due to excessive predation, environmental pollution, siltation and pathogens. The endemic New Zealand oyster *Saccostrea glomerata* has been crowded out of its natural habitat by vast numbers of exotic *Crassostrea gigas.*
Oysters have been harvested in most New World countries since early settlement and prior to that were an important natural source of food for coastal inhabitants such as Terra del Fuego Indians, Asians, American Indians, Australian Aborigines, and New Zealand Maori. In America the Eastern American Oyster (*Crassostrea virginica* Gmelin, 1791) and the Pacific Oyster *Crassostrea gigas* have been introduced to the west coast (though those liberated in San Francisco failed) from the Atlantic and Japan for the sole purpose of commercial cultivation.
The European *Ostrea edulis* is also now maricultured (a specialized branch of aquaculture involving the cultivation of marine organisms for food and other products in the open ocean, an enclosed section of the ocean, or in tanks, ponds or raceways which are filled with seawater) in the Mediterranean, Great Britain and United States (in California, Maine, and Washington States). The species once dominated European oyster production, but has been succeeded by the Pacific Oyster which now accounts for more than 75 percent of European oyster harvests.
Rock oyster stock enhancement has been practiced by aquaculturalists in many countries for some time now. Wherever oyster farming exists, the shell has always been regarded as a valuable commodity, being stockpiled after shucking, then weathered and laid to provide a settlement surface for oyster larvae. The resource has often been depleted when markets demanded oysters be sold live in the shell. Epibiotants and parasites are now controlled by artificial means, but even with such due vigilance oyster production in some localities (*e.g.* Chesapeake and Delaware Bays, Virginia, U.S.A) have declined greatly during the last twenty years due mainly to disease, but also to silting of settlement territory caused by farmland and industrial 'run-off.'

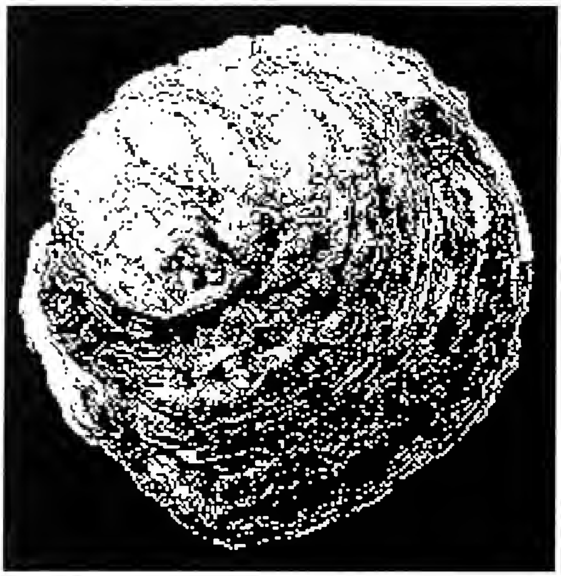

Fig. 3. Exterior view of the left valve of Ostrea edulis, Lyme Regis, England.

Enhanced commercial oyster production in New Zealand, as in the United States, involves larvae being settled onto old oyster shell in shore-based tanks. Larvae of *Ostrea chilensis* is preferred for its meat, being unique among oyster species in that it broods larvae right up to the stage where they are capable of settlement. Both the closely related native Australian flat oyster *O. angasi* and European flat oyster O. *edulis* also brood their larvae, but on release the larvae still have about a six day free swimming stage prior to settlement, offering the prospect of reduced viability. *Ostrea chilensis* possess a large egg (0.3 mm diameter) containing a large yolk reservoir to aid a developing embryo. Eye-spotted larvae (grey coloured spawn) of *O. chilensis* taken directly from opened spawning oysters are manually settled onto weathered oyster shell. Up until the larvae settle they remain yellow-cream in colour, gradually lightening as the yolk is consumed, but in later development when grey, they are known as prediveligers. A near empty yolk sac designates readiness to be liberated, settle as spat, and filter-feed on phytoplankton.

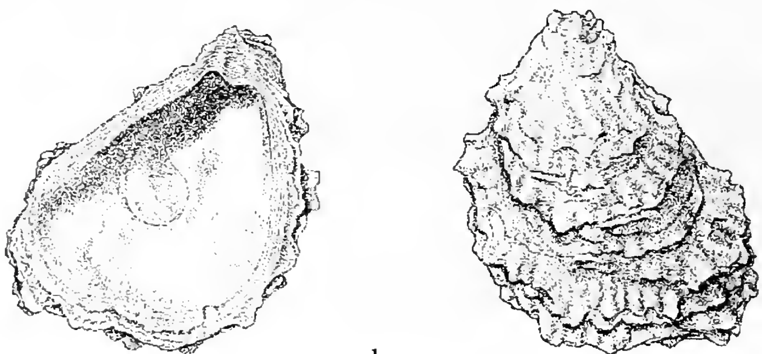

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Fig. 4. ***Ostrea chilensis*** **Philippi in Kűster, 1844: GS208, R22/f7379, Castlecliff, Wanganui, Castlecliffian Stage (almost certainly from the Tainui Shellbed), from Beu** ***et al.*** **(1990); GNS, Lower Hutt, Chapter 16: p. 340; pl. 44.**

Oysters are one of few molluscs that settle upon themselves. They are not species specific so that the young grow on other oysters, often 'choking out' themselves as well as other competing species. In a commercial oyster operation spat still settle on the shells of a previous season's settlement, too small to remove without damage (as well as being too time-consuming to do so) – an unavoidable waste.

Successful methods to circumvent this include settling oyster larvae onto clean shell enclosed in mesh bags held ashore in tanks. First tried in Puget Sound, Washington State, U.S.A. almost all commercial Pacific Oyster settlement there happens this way. New Zealand's 'Bluff Oyster' *O. chilensis* is a different species in a much more open deeper water (20-50 m) environment in stronger tides and frequent rough seas. Culturing, releasing spat and subsequent monitoring is much more difficult, though 'seed oysters' are periodically released onto dredge-plowed, barren beds to re-populate for the future. Most oyster spat of *O. chilensis* appear to grow on the curved inside of prepared oyster shell; this facilitates a better benthic stability by the mollusc since the convex side of the shell is usually orientated upward. Small juveniles that attach mainly to the inner concave surface of the shell appear free from epibiotants (*e.g.* infestation of coralline algae), indicating that these are able to settle, attach, and grow-out from the attachment surface when the host oyster shell is 'face-down' to the substrate.

Also interesting is the fact that small oysters developing on the exposed outer surface of old shells have harder shells than those growing on the inside. This is probably due to better availability of dissolved calcium carbonate in the water column and to diagenesis chemical reaction taking place on the old shell in the immediate vicinity.

Fig. 5. Known as the Pacific or Japanese oyster (Miyagi oyster), *Crassostrea gigas* is an ostreid native to the Pacific coast of Asia and, now introduced to Europe, North America, Australia, and New Zealand.

As the Gittos Point locality has illustrated, rock oysters specifically are a gregarious mollusc that can quickly occupy a suitable environmental niche in a short time. The Pacific Oyster *Crassostrea gigas* appears to be globally the most used species maricultured due to its fecundity, quicker exponential growth, and environmental tolerance. The Gittos Point locality proves these factors. Since most oysters are easy to cultivate, it is time in the form of growth, harvesting, and hygienic preparation that makes them expensive. Though many prefer mussels or scallops, a huge market exists to satisfy seafood kitchens and gastronomic diners globally.

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A Fossil Egg Case of *Alcithoe Arabica* from the Whanganui Pleistocene

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Back in the 1970s my Department conducted field classes in the Whanganui–Hawera area to study their strata and faunas.

In May 1971, together with Peter Ballance, Graham Gibson, and a bunch of 3rd-year students, I found a small white sphere embedded in the rock, hollow and empty except for two gastropod protoconchs (Fig. 1). This egg case is 11.6 mm diameter and very thin and fragile (shell material 0.2-0.3 mm thick), but it had not collapsed during compaction and lithification. It was seen because it broke in half on extraction and both halves are preserved in the collections of the Geology Programme, Auckland University's School of Environment (specimen G7161, Collection Catalogue no. AU989).

It came from the coastal cliffs west of Castlecliff, from the Shakespeare Cliff Sand at locality R22/f6469 (in the Geosciences Society of NZ Fossil Record Electronic Database, 'FRED'), along with a rich molluscan fauna and brachiopods, barnacles, other arthropods, and Bryozoa. This unit is dated as Castlecliffian Stage of the Wanganui Series and correlated with Oxygen Isotope Stage 13, about a half million years old. For the geologic setting, stratigraphy and faunal lists, see Fleming (1953), and for correlation with the oxygen isotope sequence and geomagnetic timescale, see, e.g., Carter & Naish (1999) slightly modified by Beu (2011).

Fig. 1 Egg case of *Alcithoe arabica* from Shakespeare Cliff Sand, R22/f6469, Whanganui coast, broken across and showing two unhatched protoconchs with very faint spiral lirae. Scale at lower left is in mm.

The two unemerged and undamaged 'foetal' juveniles lying within the egg are about 6.5 mm long and may be the remnant of a larger 'litter', some of which could have been lost, unnoticed, when the egg case was broken open. The remaining two are thin-shelled juveniles of about 2½ whorls

consisting of bulbous protoconchs with an eccentric paucispiral nucleus, a pyriform aperture and a straight columella showing 3 apparent plaits. The initial whorl-and-a-bit on each is smooth but there is a hint of very faint spiral lirae over the last whorl and base and the beginnings of rounded axial sculpture on the body whorl of one shell, fading out onto the base. The spiral ornament does not show up well in the figure, especially with the interior of the egg case containing also fine debris which may be organic (egg remnants) or inorganic (sand and silt), or both, and not able to be gently brushed away, but with careful focussing one can see very faint spiral threads over the body whorl. The whorl profile is smoothly rounded and the suture obvious.

Powell (1979: 211) stated that the egg case in *Alcithoe arabica* and *A. swainsoni* "is a white calcareous dome, half an inch in diameter ... Up to three embryos may develop from the egg, but if less than that number survive, then a larger protoconch results". Since then, these two 'species' have been synonymised (Bail & Limpus 2005) and recognised as ecologic variants, with the more nodulose arabica form found in harbours and the smoother swainsoni form in shallow open ocean conditions.

Penion is another gastropod genus that has direct development from the egg without a veliger stage, but Beu & Maxwell (1990: 362) record it as having "a large heavy embryonic shell (several in each large, horny egg capsule" (my emphasis). Morley (2004) states that the egg case in *A. arabica* is about 15 mm in diameter. From these points, clearly the egg case belongs to Alcithoe, but the presence of very faint spirals is not mentioned in any description I have seen of the species in that genus.

Examination of specimens in the reference collection of the University of Auckland Geology Programme shows that some specimens do in fact posses weak spirals. Most, however, are too worn or corroded for them to be preserved, even if previously present. Two specimens from the Castlecliff Castlecliffian, both labelled G6718, prove to have 4-5 weak spiral threads on the first post-neanic whorl which then fade away and the whorls assume the 'swainsoni'-type form. A specimen (G2040) of *A. (Leporemax) brevis* from the Nukumaruan strata (2.4 – 1.7 million years old) of Kereru, Hawkes Bay, has a large smooth globose protoconch of two whorls followed by a half-whorl with four weak spirals, after which the axials begin. A second specimen of this species, from AU5727, Ruataniwha, also Nukumaruan, shows this same sculptural development. No specimens of *A. (L.) fusus* examined by me show spirals other than a faint angulation on the third post-neanic whorl; this on later whorls becomes the shoulder of the shell. Spirals of the type described above do not seem to be present in unworn specimens of this species.

Fleming (1953) included *Alcithoe swainsoni* and *A. (Leporemax) fusus* in the fauna he recorded from the Shakespeare Cliff Sand. Beu & Maxwell (1990) stated that the protoconch of *A. arabica* and *A. fusus* are very similar, except that in arabica the protoconch is large and 4-5 mm wide, and in fusus it is small and 2-3 mm wide. The fossil specimens are ~ 3.5 and 4.0 mm wide and thus conform more closely to *Alcithoe arabica*, and this is the identification accepted here. Perhaps the incipient axial sculpture on the protoconchs suggests the swainsoni form and an open ocean site.

Eggs are very rare objects in the fossil record, and I am aware of few other reported occurrences in the New Zealand fauna, none of which is of molluscan origin and most of which are merely eggshell: Worthy & Grant-Mackie (2003) recorded the presence of two partial eggs of the Little Blue Penguin, *Eudyptula minor*, from Pleistocene deposits at Oamaru; eggs and eggshell of Moa (Dinornithiformes) are well-known from Late Quaternary dune and other sequences in various parts of New Zealand (e.g. Gill. 2006), and eggshell is reported with moa bone fragments in the Miocene Manuherikia Formation, Central Otago (Tennyson et al. 2010). Overseas, fossil eggs are occasionally reported, most notably those of dinosaurs (for those interested, for instance, Google 'fossil eggs'), but fossil molluscan egg cases do not figure in either Google or Wikipedia entries, so may be unknown. I have found no record in any of the world literature I have consulted and Cox (1960), a prominent molluscan specialist who contributed to the relevant volume of the Treatise on Invertebrate Paleontology, stated therein that he also knew of none.

It would seem that this record of a fossil gastropod egg case may be the first for both New Zealand and globally!

ACKNOWLEDGEMENTS

Alan Beu, GNS Science, Lower Hutt, has been most helpful in bringing me up to date on the state of knowledge of systematic in Alcithoe.

The photography was largely done by Neville Hudson and Ritchie Sims, Auckland University Geology Programme.

Neville also curated this specimen and provided helpful discussion of its identity.

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Marjorie Mestayer (1880-1955) and her Molluscan Studies and Collections

By Bruce W. Hayward and Margaret S. Morley

Marjorie Mestayer was a significant figure in early 20th century New Zealand conchology, but it is hard to find out much about her. No obituary appears to have been written (Bruce Marshall pers. comm.), and we largely remember her from the molluscan, foraminiferal and ostracod species named after her and the few molluscan species that she described that are still recognised as valid.

Marjorie was born in England in 1880 and migrated to Australia with her parents when she was 2. They moved to Wellington when she was 12, where her father, Richard, was appointed engineer in charge of the design and construction of the city's sewerage system. Richard Mestayer was also an amateur naturalist with interests in things microscopic, like foraminifera. Undoubtedly his enthusiasm for the natural world rubbed off on Marjorie, who was described by Henry Suter (1906, p.322) as "our most enthusiastic conchologist" when he named *Heliconiscus mestayerae* (a junior synonym of *Cellana testudinaria*) after her, with the type being "in Miss Marjorie K. Mestayer's cabinet".

Marjorie never married. In Wellington she lived most, if not all of her life in the family home in Sydney St, Thorndon. She was appointed by the Dominion Museum as Conchologist from 1 May 1919 to 30 April 1932 (Bruce Marshall, pers. comm.) and died 7 Sept 1955 (Karori Cemetery database). It appears that she was employed on contracts and at various times she obtained small grants to undertake molluscan field work from the Wellington Philosophical Society and New Zealand Institute. In June 1932 she wrote to Baden Powell (Auckland Museum archives MS 1562) saying "I have been one of the retrenchment victims. Now I am trying to earn a little money by making home-made sweets."

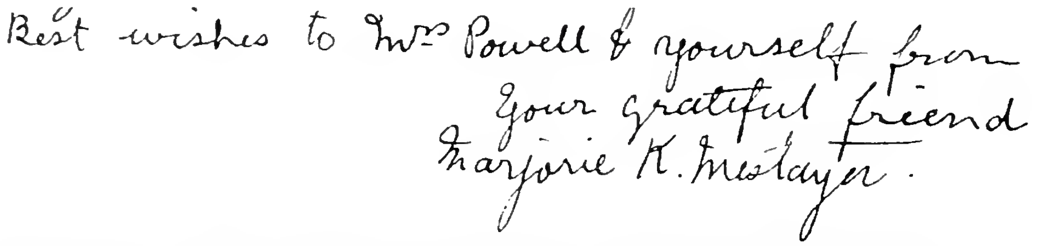
The late Baden Powell and Dick Dell described her as "a rather large lady with a small head" that they liked to play tricks on. One often repeated anecdote is of Baden and Dick sending her specimens of a new shell-shaped dried pasta that appeared on the market asking for her opinion on its identification. The story goes that she believed it to be a new species and prepared a description and name for it, before the tricksters informed her of its real origin. We like to think that she knew all along and was just going along with the joke.

While still a teenager, Marjorie started her molluscan interests, inspired by seashore forays led by Sir James Hector (Anon, 1928). In 1897, her father as a member of the Wellington Philosophical Society, "exhibited a collection of chitons found in Lyall Bay, named by Captain Hutton, and collected by Miss Mestayer" at a society meeting (Transactions and Proceedings of the NZ Institute 30). Marjorie's first publication was with mollusc expert Tom Iredale on shells also from Wellington's Lyall Bay (Iredale and Mestayer, 1906). The introduction to this report states "All the larger shells were collected by Miss Mestayer, whilst the minute forms were sorted and identified by Tom Iredale from shell-sand and seaweed-washings collected by Miss Mestayer."

Marjorie furthered her studies by collecting shell sand from Wellington's Titahi and Maheno Bays. During these and other studies she clearly consulted widely and obtained the opinions on identifications from most of Australasia's leading conchologists of the early 20th century. Presumably her father with his Philosophical Society connections helped her make many of these acquaintances at an early age. They included Tom Iredale (Australian Museum), Henry Suter, J. Allan Thomson, Walter (W.R.B.) Oliver, Jack Marwick (NZ Geological Survey), Baden (A.W.B.)

Powell, and even Charles Hedley (Australian Museum). She named species after all of these gentlemen, except Iredale and Powell (see list below). Suter, Marwick, Powell and Iredale (named 4) also named species in her honour (see list), mostly specimens she had collected or had sent to them.

Copies of some of Marjorie's correspondence with Baden Powell (Auckland Museum conchologist) are in the library of Auckland Museum and clearly show that the two had a friendly and mutually beneficial relationship. Both loaned and donated specimens to each other and to their respective museums. Initially Powell could not obtain the proceedings of the Malacological Society in Auckland and Marjorie would send him her copies on loan. Each addressed each other in a formal way, as they did in those days – "Dear Mr Powell"; "Dear Miss Mestayer"; but Marjorie signed her letters less formally – "Yours gratefully"; "Best wishes to Mrs Powell and yourself from Your grateful friend, Marjorie Mestayer".


Best wishes to Mrs Powell & yourself from
Your grateful friend
Marjorie K. Mestayer.

End of letter to Baden Powell, August 14th 1930 (Auckland Museum Library)

Baden Powell always signed off "Yours sincerely", although on one occasion he added "Trusting that both mother and yourself are well and again thanking you for the use of the subantarctic dredgings".

Marjorie's other major source of modern New Zealand shell specimens was from Captain John Peter Bollons (1869-1929). He was a well-known mariner and captain of the government steamer Hinemoa and later Tutanekai from 1898 to 1929. These ships sailed all around New Zealand's coastline and its subantarctic dependencies, servicing lighthouses, maintaining navigation aids, charting the coast, replenishing relief depots and conducting search and rescue missions. These voyages enabled Bollons to pursue his interests in natural history and he had his own small dredging apparatus for collecting seafloor samples (McLean, 2010).
Bollons supplied Marjorie Mestayer with sediment samples from many of his dredgings, especially from around some of the offshore and outlying islands. At that time there were few "deep-water" or offshore samples from such remote places as the Auckland Islands, Snares, Three Kings, North Cape, Poor Knights, Great Barrier, Cuvier and Hen and Chickens Islands. Bollons' dredgings supplied the first specimens of many new-to-science mollusc species, some of which Marjorie described and named (e.g. Mestayer, 1916, 1919) but many of which she gave to other colleagues to describe (e.g. Powell, 1930, 1933) either as specimens she had separated out or as a split of her bulk sediment samples.

The practice of sharing material and donating specimens between conchologists appears to have been widespread (except with Harold Finlay) and it seems to have been accepted that if you named and described a new species then the type was usually placed in your personal collection or that of your local institution. Thus the types of many of Marjorie's new species were said to be in her collection, but these have since been transferred to the National Museum, now Te Papa. Nowadays lodging types of a new species in a private collection is understandably not acceptable.

At the Dominion Museum, Marjorie was apparently a diligent and careful curator. Jack Marwick (1929) said of her "The Dominion Museum specimens were prepared by Miss M. Mestayer with great care, and thus were preserved many fragile specimens which would otherwise have been lost."

Despite her position as Conchologist with the Dominion Museum, Marjorie was not terribly productive in her molluscan taxonomic studies. Most of her publications make extensive references to the opinions of other conchologists as to whether the taxa being described were separate new species or not. Unlike most conchologists of her day, Marjorie was not a good artist and all her new species were illustrated for her, mostly by Miss J.K. Allan of the Australian Museum, Sydney, but some drawings she also acknowledged to Jack Marwick and Baden Powell.

Marjorie Mestayer's significance to Auckland Museum lies in the number of specimens (>100) and lots of shell sand (46 bulk lots) that she sent to Baden Powell, that are still housed in the Auckland Museum Marine Department collections, some becoming the types of new species.

Mestayer's taxonomic work was mainly divided between gastropods and chitons. She established two genera –*Mangonuia* and *Awarua* both of which are now considered to be junior synonyms of earlier described genera (see list).
Of the 8 chiton species she described, 3 (one fossil) are still considered to be valid. Nine (one fossil) of the 18 gastropod species she described are still considered to be valid, but the two bivalve and one scaphopod species she named are all now considered to be junior synonyms of earlier described species (see list). Many of the species she described and named have proved to be junior synonyms of others previously described, undoubtedly some of this was caused by the difficulty of obtaining access to early literature at the time or the inadequacy of the early descriptions. One of the mollusc species described by Marjorie (*Hipponyx inexpectata*) has proved to be the operculum of a polychaete worm. Clearly at some stage, possibly as a youngster, Marjorie was not as careful with her labelling as she might have been, as two species from her collection that were described as new species with New Zealand type localities (one by Suter and one by her) have turned out to be common tropical shells which clearly had incorrect locality data.

Of the 9 mollusc species named in honour of Marjorie (see list), 5 (one fossil) are still considered to be valid – *Parachiton mestayerae*, *Cumia mestayerae*, *Cyclochlamys mestayerae*, *Eulimella mestayerae* and *Perrierina mestayerae.*

ACKNOWLEDGMENTS
We thank Bruce Marshall and Alan Beu for their helpful suggestions and corrections to this manuscript.
We also thank Elizabeth Lorimer and Martin Collett for providing access to the manuscripts and letters archives in Auckland War Memorial Museum library.

SPECIES NAMED IN HONOUR OF MARJORIE MESTAYER

Lepidopleurus mestayerae Iredale, 1914. Still considered valid (pers. comm. B Marshall).
Parachiton mestayerae Iredale, 1914 fossil. Still considered valid.
Buccinulum strebeli mestayerae Powell, 1929 = *Buccinulum vittatum* (Quoy & Gaimard, 1833)
Fusus mestayerae Iredale, 1915 = *Cumia mestayerae* (Iredale, 1915). Still considered valid.
Heliconiscus mestayerae Suter 1906 = *Cellana testudinaria* (Linnaeus, 1758)
Syrnola mestayerae Marwick, 1931 = *Eulimella mestayerae* (Marwick, 1931) fossil. Still considered valid.
Cyclopecten mestayerae Dell, 1956 = *Cyclochlamys mestayerae* (Dell, 1956). Still considered valid.
Lima mestayerae Marwick, 1924; Hawkes Bay, Pleistocene = *Lima zealandica* Sowerby, 1876
Perrierina mestayerae Powell, 1933. Still considered valid.

MOLLUSC TAXA DESCRIBED BY MARJORIE MESTAYER

Genera

Awarua Mestayer, 1930 = *Pseudotorinia* Sacco, 1892
Mangonuia Mestayer, 1930 = *Pseudomalaxis* Fischer, 1885

Species

All types are now housed in Museum of New Zealand. All specimens originally lodged in the Mestayer collection are now in the Museum of New Zealand.

Polyplacophora

Acanthochitona foveauxensis Mestayer, 1926 = *Notoplax rubiginosa* (Hutton, 1872), type from Foveaux Strait.

Acanthochitona foveauxensis var. *kirki* Mestayer, 1926 = *Notoplax rubiginosa* (Hutton, 1872), type from Foveaux Strait.

Callochiton kapitiensis Mestayer, 1926, type from Kapiti Island. Still considered valid.

Lorica haurakiensis Mestayer, 1921, types from 20 fms, off Kawau I (from A.E. Brookes). Still considered valid.

Macandrellus oliveri Mestayer, 1926 = *Notoplax rubiginosa* (Hutton, 1872), types from 20 fms, Hauraki Gulf, (from W.R.B. Oliver).

Plaxiphora (Maorichiton) lyallensis Mestayer, 1921 = *Plaxiphora caelata* (Reeve, 1847), type from Lyall Bay, Wellington.

Rhyssoplax allanthomsoni Mestayer, 1929, type from Oligocene, Chatton. Still considered valid.

Rhyssoplax oliveri Mestayer, 1921= *Rhyssoplax aerea* (Reeve, 1847) types from Lyall Bay (from W.R.B. Oliver).

Bivalvia

Pallium kapitiensis Mestayer, 1929 = *Mesopeplum convexum* (Quoy and Gaimard, 1835), type from stomach of blue cod off Kapiti I. (from Watson Bros.).

Pecten (Cyclopecten) hinemoa Mestayer, 1927, holotype from off Big King (dredged by Hinemoa). Still considered valid.

Gastropoda

Brookula rexensis Mestayer, 1927 = *Brookula prognata* (Finlay, 1926), holotype from 98 fms, off Big King, Three Kings Is, in Mestayer collection.

Crossea cuvieriana Mestayer, 1919 = *Crosseola cuvieriana* (Mestayer, 1919), type from 38-40 fms, Cuvier I. Still considered valid.

Damoniella alpha Mestayer, 1921 = *Roxania alpha* (Mestayer, 1921), type from early Miocene, Blue Cliffs, South Canterbury (from J.A. Thomson). Still considered valid.

Discohelix hedleyi Mestayer, 1916 = *Zerotula hedleyi* (Mestayer, 1916), type from 98 fms, Big King, Three Kings Is. Still considered valid.

Fusitriton futuristi Mestayer, 1927 = *Fusitriton magellanicus laudandus* Finlay, 1926, holotype from 50-60 fms, Cape Campbell (from Mr H Hamilton from the Steam trawler Futurist).

Hipponyx inexpectata Mestayer, 1929 = Invalid species, as it is the operculum of a polychaete worm (Dell, 1956, p.72), type from off Big King, 98 fms, in Mestayer collection.

Leucosyrinx cuvieriensis Mestayer, 1919 = *Terefundus cuvieriensis* (Mestayer, 1919), types from 38-40 fms, Cuvier I. Still considered valid.

Leucosyrinx thomsoni Mestayer, 1919 = *Taranis nexilis bicarinata* (Suter, 1915), types from 25-26 fms, Hen and Chickens Is.

Liotia suteri Mestayer, 1919 = *Munditia suteri* (Mestayer, 1919), type from 70 fms, Bounty Is. Still considered valid.

Mangonuia bollonsi Mestayer, 1930 = *Pseudomalaxis zanclaeus meridionalis* (Hedley, 1903), types from 75 fms, off North Cape, in Mestayer collection.
Monodonta lugubris var. *albina* Mestayer, 1927 = *Diloma bicaniculata* (Dunker, 1844), holotype from Lyall Bay, in Mestayer collection.
Montfortula lyallensis Mestayer, 1928 = *Montfortula rugosa* (Quoy and Gaimard, 1834), holotype from Lyall Bay, in Mestayer collection.
Orbitestella hinemoa Mestayer, 1919, types from 50 fms, Snares Is. Still considered valid.
Scissurella regia Mestayer, 1916 = *Anatomia regia* (Mestayer, 1916) holotype from 98 fms, off Big King, Three Kings Is, in Mestayer collection. Still considered valid.
Triviella gamma Mestayer, 1927 = *Trivea pediculus* (Linnaeus, 1758), holotype said to be from Bay of Islands, in Mestayer collection; but not a NZ shell, instead it is this common species from the Caribbean (Powell, 1979, p.152).
Triviella maoriensis Mestayer, 1927 = *Trivea merces* (Iredale, 1924), holotype from Reef Pt, Ahipara (from Dr Bucknill) in Mestayer collection.
Typhis pauperis Mestayer, 1916 = *Monstrotyphis pauperis* (Mestayer, 1916), holotype from 60 fms, Poor Knights, Mestayer collection. Still considered valid.
Veprecula cooperi Mestayer, 1919, type from 25-30 fms, Hen and Chickens Is. Still considered valid.

Scaphopoda
Dentalium marwicki Mestayer, 1926 = *Antalis nana* (Hutton, 1873), types from Pliocene, Castlecliff, Wanganui.

OTHER SPECIES WITH TYPE SPECIMENS FROM MARJORIE MESTAYER COLLECTIONS

Polyplacophora
Chiton huttoni Suter, 1906 = *Rhyssoplax aerea* (Suter, 1906); Lyall Bay.

Bivalvia
Arthritica crassiformis Powell, 1933; Maheno Bay, Wellington.
Dosinia maoriana Oliver, 1923; Elmsie Bay, Marlborough Sounds.
Perrierina mestayerae Powell, 1933; 50 fms, Snares Is (Capt. Bollons).

Gastropoda
Acmea parviconoidea nigrostella Suter, 1907 = *Notoacmea parviconoidea* (Suter, 1907); Titahi Bay.
Heliconiscus mestayerae Suter, 1906 = *Cellana testudinaria* (Linneaus, 1758); said to be Stewart Island, but clearly from Indo-Pacific (Iredale, 1915).
Legrandina aucklandica Powell, 1933; beach drift, Faith Hbr, Auckland Is (Capt. Bollons).
Macquariella aucklandica Powell, 1933 = *Laevilitorina aucklandica* (Powell, 1933); beach drift, Faith Hbr, Auckland Is (Capt. Bollons).
Ovirissoa delli Ponder, 1968 = *Onoba delli* (Ponder, 1968); Lyall Bay
Rissoa (*Cingula*) *lampra* Suter, 1908 = *Eatoniella lampra* (Suter, 1908); Titahi Bay.
Rissoa (*Cingula*) *roseocincta* Suter, 1908 = *Eatoniella roseocincta* (Suter, 1908); Titahi Bay.
Rissoa (*Setia*) *infecta* Suter, 1908 = *Pusillina infecta* (Suter, 1908); Lyall Bay, Wellington.
Rissoella flemingi Ponder, 1968; Lyall Bay, Wellington.
Subonoba delicatula Powell, 1933 = *Onoba delicatula* (Powell, 1933); beach drift, Faith Hbr, Auckland Is (Capt. Bollons).
Subonoba tenuistriata Powell, 1933 = *Onoba tenuistriata* (Powell, 1933); 95 fms, Auckland Is.
Tasmalira wellingtonense Dell, 1956 = *Tasmalira vitrea* (Suter, 1908); Lyall Bay.
Terebra tristis crassicostata Suter, 1909 = *Pervicacia tristis* (Deshayes, 1859); Lyall Bay.

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Mestayer, M. K. 1919. New species of Mollusca, from various dredgings taken off the coast of New Zealand, the Snares Islands, and the Bounty Islands. *Transactions and Proceedings of the New Zealand Institute* **51**: 130-135.

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SEA SHORE SHELLS

HOW many women, once having survived the experience of being chased out of a pool by a large and indignant octopus, would go back and ask for more?

Few and far between such hardy ladies may be, but Miss Marjorie Mestayer, who has charge of the Conchological Department at the Dominion Museum, holds that such little incidents are part of the day's work and that, anyhow, the octopus probably felt worse about it than she did.

For many years, Miss Mestayer has hunted shells, waded for shells, cleaned shells, classified shells, and in general fitted herself for the post which she now occupies—that of the only woman conchological expert in the Dominion.

She was given her present post at the Museum several years back, mainly because Wellington could at that time produce no man who knew much more about shells than that they were curious things found on beaches. But even before her appointment to the Museum staff, Miss Mestayer had been sent on several shell-hunting expeditions throughout the North Island by the Government, and had brought back important collections.

Sir James Hector, who was the first director of the Dominion Museum, started Miss Mestayer off along the shelly track. Around Island and Lyall Bays began rambling expeditions, when the queer treasure trove of the sea-floor were brought, much against their own inclination, to light.

Horny old limpets clung fast to their rocks, octopi protested as best they might against intrusions on their privacy, but Miss Mestayer's collection kept on growing, and her knowledge of shell-science grew with it.

Miss Mestayer, in her leisure moments, is as nearly aquatic as a human being can be. The rock-combing expeditions need an informal costume of bathing suit and stout shoes—the latter being for the discouragement of any small octopus who may look upon feminine ankles as a lunch prospect.

"Look through the microscope at this tube," says Miss Mestayer. A glance reveals hundreds of tiny shells—the daddy of them all less than a quarter of an inch across—yet gleaming with different colors and twisted into a multitude of delicate shapes.

To contrast with these, a huge mussel, twelve inches long, is produced from a show case; or some fan shells—the same that ancient pilgrims wore in their hats to prove that they had visited the Holy Land—are shown in sizes which would do excellently for soup plates.

Four glass showcases are given over to a picturesque copy of sea-bottom—some of it shallow, as in the little pink rock pools where our sand-babies scarcely have room to dabble their toes, the rest green and mysterious, as the world must look at fifty fathoms deep.

Item from NZ Truth, 6 December 1928

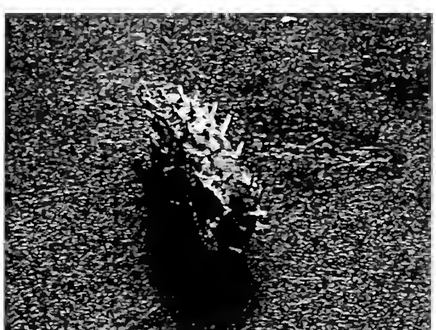
Between The Tides: Beachcombing Muriwai and Rangatira Beaches

by Michael K. Eagle

Muriwai Beach is a resilient space, always reverberating with the incessant smashing of surf on coastal rocks or surf upon the long, black titanomagnetite beach. Gusting wind and swirling sand drive spinnifex seed heads along it, and from time to time the rusting carcass of a dead vehicle protrudes from the tidal-zone. There are various iconic images about Muriwai such as the Miocene sandstone cliffs of Motutara, the onshore gannet colony, surf-fishing (with kites, torpedoes, and rods), para-water-skiing, land yacht sailing, surfing and beachcombing for buoys, fishing floats, Whale bone and molluscs. Pig (*Sus scrofa*) and Fallow Deer (*Cervus dama dama*) or their footprints are sometimes seen when animals leave Woodhill Forest. More often than not, dead animals (seals, sea-snakes, turtles, various sea-birds, fish, whales) are encountered as are the overboard flotsam debris of foreign fishing boats and container vessels. Holed nets, ropes, wood, glass bottles, product stamps, plastic pellets and containers of various descriptions (many covered in goose-barnacles (*Lepas anatifera*)), some also on wood (logs, posts and planks) are cast ashore as beach-drift.

A 40 km journey up both Muriwai and Rangatira Beaches in a neighbour's 1960 short-wheel-base, Land Rover between (low (1432 hrs) and high (0822 hrs)) tides on 12/13 August 2011, beachcombing for ambergris reaped many surprises. As well as some of those already mentioned: a 20 mm cannon 'shell' (A Royal New Zealand Air Force Skyhawk remnant?), 303, 243 and 30-06 (hunting rifle) brass cartridge cases, a piece of Kauri gum, four coconuts, a Samoan breadfruit seed, many corks, a Humpback whale (*Megaptera novaeangliae*) flipper bone, a dead Fur Seal pup (*Arctocephalus forsteri*), many dead Broad-billed Prions (*Pachyptila vittata vittata*) three dead Gannets (*Morus serrator*), several dead Paddle Crabs (*Ovalipes catharus*), and two dead Porcupine fish (*Allomycterus jaculiferus*) were recorded. Amphipods scavenged beneath dead animals and the Bull Kelp (*Durvillia antarctica*), but no flies were seen, probably because of the cold, blustery (yet sunny) conditions of the day. Of note is that no limpets, sea-stars or jellyfish were seen, though some large barnacles (*Balanus decorus*), and sections of snapper biscuits (*Fellaster zelandiae*) were.

Washed-up coconuts.

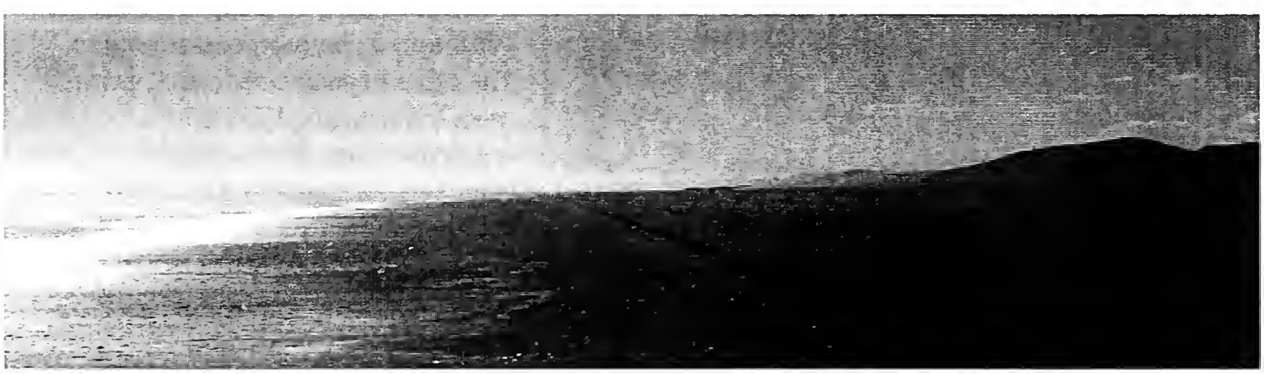


Porcupine fish.

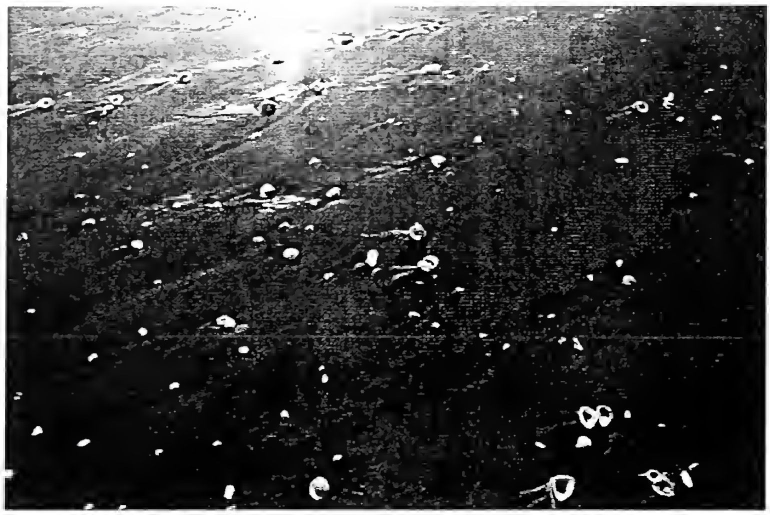
Rusted vehicle remains.

Small clusters of birds standing above the wash zone included: Caspian Terns (*Hyroprogne caspia*), Variable Oystercatchers (*Haematopus unicolor*) probing for worms, Red-billed Gulls (*Larus novaehollandiae scopulinus*), Dominican Gulls (*Larus dominicanus*), several Pied Shags (*Palacrocorax varius*), and a lone New Zealand Black-browed Mollymawk (*Diomedea melanophyrs impavida*). In several places gannets were fishing in and beyond the breakers. Also of interest was a single Katipo spider (*Latrodectus katipo*) found living on an old salt-laden driftwood pine tree. Many Toheroa siphon holes were spotted covering three beds spread some considerable distance apart up the beach. Numbers did not seem great. A green phytoplankton scum lined the tide line.

Muriwai and the more northern Rangitira Beach (joined together as one) are dominated by bivalves, mainly: archetypical surf clams: the mactrids *Mactra discors* Gray, 1837, and *Crassula aequilatera* (Deshayes in Reeve, 1854) are most common, as is the Toheroa *Paphies ventricosa* (Gray, 1843), but not so *Zenatia* (*Zenatia*) *acinaces* (Quoy and Gaimard, 1835) of which only two specimens were found some distance apart. In many places *Peronaea gaimardi* (Iredale, 1915) and *Austrodosinia anus* (Philippi, 1848) are also abundant, with many juveniles washed-up, perhaps denoting healthy populations off-shore. Large (up to three times the size of Recent specimens) intact and partially broken valves of Toheroa shells (c.dated:1000 years ± 100 years), exhumed from several beach localities (part of an old paleo-shoreline) were also collected. The purple tellinid *Hiatula nitida* (Gray, 1843) is common, but valves are rarely conjoined, with one usually broken away from the beak. It is presumed living off-shore, as is *Struthiolaria* (*Struthiolaria*) *papulosa* (Martyn, 1784). *Hiatella arctica* (Linnaeus, 1767) was collected from the hold fasts of dead and drying Bull Kelp, but a few valves were seen amongst the debris on past high-tide lines. An entire, desiccated specimen of the callochitinid *Eudoxochiton nobilis* (Gray in Dieffenbach, 1843), shattered pieces of *Haliotis iris* (Gmelin, 1791), and the turbinid *Cookia sulcata* (Gmelin, 1791), is the expected evidence of a rocky coastline community to the south of Muriwai Beach, between Motutara and Anawhata.



The occurrence of the common cockle *Austrovenus stuchburyi* (Gray in Wood, 1828) is explained as either outwash (dead-bloated and drifting) from the Manukau or Kaipara Harbours (like the mangrove seeds found), or small populations (small-sized) living in shallow troughs and/or holes sub-tidally. The other venerid, *Austrodosinia anus* probably lives there too. Cemented oyster shells of *Crassostrea gigas* (Thunberg, 1793) and *Saccostrea glomerata* (Gould, 1850) as well as the common scallop *Pecten novaezelandiae* Reeve, 1853 may have also been tidally carried out of the harbours and deposited on the beach by long-shore current drift or storm action. There is little prospect of the scallop being able to live epi-faunally in such a tumultuous ecological niche, and little attachment for oysters. A number of *Alcithoe* (*Alcithoe*) *arabica* (Gmelin, 1791) from the inner shelf were noted (mainly '*swainsoni motutaraensis*' Powell, 1928 forms) complimenting a number of seemingly small, but persistent beds of *Panopea zelandica* (Quoy and Gaimard, 1835). A single middle to outer shelf neptunid *Ranella olearium* Linaeus, 1758, was a surprise discovery.



Mactra, Crassula, and Austrodosina

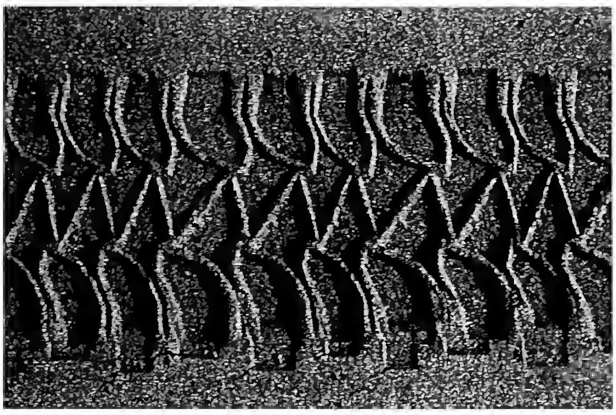
Muriwai Beach

Rangatira Beach

Most of the gastropods found were damaged, having been driven upon the shore from a benthic repose within a high-energy environment including the storm base. Only five gastropods were found intact: the monoplane structure of *Scutus breviculus* (Blainville, 1817); the robust, helical form and strengthened pustule ribbed *Calliostoma* (*Maurea*) *selectum* (Dillwyn, 1817); a juvenile *Semicassis* (*Semicassis*) *pyrum* (Lamarck, 1822) with an epibiotant sand worm casing which probably aided stability by giving more weight to the shell; semi-pelagic ocean wanderers *Janthina exigua* Lamark, 1822 and *Janthina janthina* Linnaeus, 1758; and the spine-stabilised muricid *Poirieria zelandica* (Quoy and Gaimard, 1833).

The record here-in of one of the largest cuttle-fish in the world, the giant Australian *Sepia apama*? Gray, 1849 is based on the large size of the internal 'float'. However, it may simply represent an extraordinarily oversized *Sepia officinalis* Linnaeus, 1758 found common cosmopolitan. The other cephalopod found *Spirula spirula* Linnaeus, 1758 with segmented internal buoyancy chambers arranged in a decoiled spiral, cluttered successive tide lines the entire length of the beach, the remains of hundreds of individuals with a nektic lifestyle and cosmopolitan distribution.

A systematic list of molluscan species recorded on the day is annotated below.
Taxonomy and nomenclature follows that of: Maxwell, P. *In*: Gordon D. P. (Editor) 2009. *New Zealand Inventory of Biodiversity: Volume One, Kingdom Animalia, Radiata, Lophotrochozoa, Dueterostomia*. Canterbury University Press: 232-254; and Morton, J. with Hayward, B. W. (Science.editor) 2004. *Seashore Ecology of New Zealand and the Pacific*. David Bateman: 504p.



POLYPLACOPHORA		
	ISCHNOCHITONIDAE	*Eudoxochiton nobilis* (Gray in Dieffenbach, 1843)
BIVALVIA		
	MYTILIDAE	*Perna canaliculus* (Gmelin, 1791)
	OSTREIDAE	*Crassostrea gigas* (Thunberg, 1793)
		Saccostrea glomerata (Gould, 1850)
	PECTINIDAE	*Pecten novaezelandiae* Reeve, 1853
	MACTRIDAE	*Mactra discors* Gray, 1837
		Crassula aequilatera (Deshayes in Reeve, 1854)
		Zenatia (Zenatia) acinaces (Quoy and Gaimard, 1835)
	MESOMESMATIDAE	*Paphies ventricosa* (Gray, 1843)
	PSAMMOBIIDAE	*Hiatula nitida* (Gray, 1843)
	TELLINIDAE	*Peronaea gaimardi* (Iredale, 1915)
	VENEROIDAE	*Austrovenus stuchburyi* (Gray in Wood, 1828)
		Austrodosinia anus (Philippi, 1848)
	HIATELLIDAE	*Hiatella arctica* (Linnaeus, 1767)
		Panopea zelandica (Quoy and Gaimard, 1835)
GASTROPODA		
	HALIOTIDAE	*Haliotis iris* (Gmelin, 1791)
	FISSURELLIDAE	*Scutus breviculus* (Blainville, 1817)
	CALLISTOMATIIDAE	*Calliostoma (Maurea) selectum* (Dillwyn, 1817)
	TURBINIDAE	*Cookia sulcata* (Gmelin, 1791)
	STRUTHIOLARIIDAE	*Struthiolaria (Struthiolaria) papulosa* (Martyn, 1784)
	CASSIDAE	*Semicassis (Semicassis) pyrum* (Lamarck, 1822)
	RANELLIDAE	*Ranella olearium* Linaeus, 1758
	JANTHINIDAE	*Janthina exigua* Lamark, 1822
		Janthina janthina Linnaeus, 1758
	BUCCINIDAE	*Austrofusus (Austrofusus) glans* (Röding, 1798)
		Cominella (Cominella) maculosa (Martyn, 1784)
		Penion sulcatus (Lamarck, 1816)
	MURICIDAE	*Poirieria zelandica* (Quoy and Gaimard, 1833)
		Dicathais orbita (Gmelin, 1791)
	VOLUTIDAE	*Alcithoe (Alcithoe) arabica* (Gmelin, 1791)
CEPHALOPODA		
	SEPIIDAE	*Sepia apama*? Gray, 1849
	SPIRULIDAE	*Spirula spirula* Linnaeus, 1758

Manukau Harbour Mollusc Survey, 1952 to 1963

Margaret S. Morley[1], Bruce W. Hayward[2] and Ken Hipkins[3]
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[2] Geomarine Research, 49 Swainston Rd, St Johns, Auckland,
[3]Deceased

Summary
We present the results of an unpublished molluscan survey of the Manukau Harbour by members of the Conchology Section of the Auckland Museum and Institute from 1952-1963. One hundred and forty-four mollusc species (8 Polyplacophora, 44 Bivalvia, 1 Scaphopoda, 95 Gastropoda, 1 Cephalopoda) are recorded. Twenty-five additional species (1 Polyplacophora, 3 Bivalvia and 21 Gastropoda) from Whatipu, north Manukau Heads and Wattle Bay, near south Manukau Heads, are also included. These were not listed in the unpublished book of Manukau Harbour records but were mostly sourced from separate lists by Albert H. Jones (unpublished 1952). A few other additions came from old Conchology Section newsletters. Most specimens were intertidal but some of the specimens were dredged or taken by SCUBA, these are marked in the species list with an asterix. Hulme (1959) recorded details of a dredging trip in 1961 comprising 22 stations in the Manukau Harbour between Weymouth and Whatipu. Bottom profiles were made, in depths of 6-30 m. Only a few molluscs were found, this was thought to be due to adverse conditions in the channel caused by strong tidal currents. Notes on the observers whose records make up the book are included where known.
Species recorded in the historical survey of the Manukau Harbour but apparently not present there today are *Semicassis pyrum*, *Tonna tankervillii*, *Zelippistes benhami*, *Trichosirius inornatus*, *Charonia lampas*, *Alcithoe arabica*, and *Boreoscala zelebori*. Norman Douglas's large Manukau Harbour collection from the 1950-60s shows that today's fauna is less diverse, and specimens are significantly smaller. We expect to publish further detailed comparision between species in the 1950's survey and today when the current survey is completed.

Introduction
In the 1950s and early 1960s members of the Conchology Section of Auckland Institute and Museum undertook a significant survey of the molluscs of the Manukau Harbour and the results were typed up as species records in a special book set aside for the purpose. This book has been missing for many years, though an old photograph shows it being presented by the Conchology Section to the Auckland Museum Institute, probably in the 1970s. The book, which cost 12 shillings, consists of 150 typed sheets (Fig. 1). It was rediscovered, rather appropriately, on the 80th anniversary of the Conchology Section in October 2010 by librarian Gladys Goulstone and one of the authors (MSM) while looking through old papers in the Shell Club library. There was much rejoicing as it contains a valuable snapshot of molluscs present at that time. Since then other Manukau Harbour documents have been tracked down adding species not in the book.

Species list
Although not stated, the compiler of the book was almost certainly Ken Hipkins as revealed in an old unpublished account of a members' trip to Te Tau Bank in 1961. "This list is from Mrs Morgan, Mr and Mrs Barker and Mrs Seagar. We hope that a complete list will be given to Mr Hipkins to add to the list already compiled for the Manukau Survey." Ida Worthy was secretary at the time and Alma Morgan was the assistant secretary, they probably assisted Ken. He was president of the Conchology Section from 1958 to 1961 (Poirieria 50th Anniversary edition). His name figures prominently in the list of observers in the book.

14

MANUKAU HARBOUR SURVEY OF MOLLUSCAN SPECIES.
OSTREIDAE.

Ostrea linnaeus, 1758 (O. edulus Linn). sinuata lamark, 1819. Habitat: on flat shelving sand near low water.	LOCALITY: WATTLE BAY, NEAR SOUTH HEAD. 26th, Dec, 1952.
Ostrea sinuata Lamark, 1819. Habitat: on sandy mud low water.	LOCALITY: TE TAU BANK 2nd, jan, 1953. Observed: by W.m. P. Thomson.
Habitat: on sand, near low tid mark, alive	LOCALITY: CORNWALLIS BEACH. 24th Nov, 1953. observed by A. H. Jones.
Habitat: attached to reef near low water.	LOCALITY: BETWEEN MILL BAY & PARAU. observed by W.m. P. Thomson. 26th, Sept 1953
Habitat: on muddy bottom at low tide mark.	LOCALITY: JENKINS BAY TITIRANGI. observed by W.m. P. Thomson. 20th, Sept, 1952
Habitat: on mud mid tide.	LOCALITY: MILL BAY NEAR ONEHUNGA WHARF. observed by A. H. Jones. 7th, May, 1953.
Habitat: dead sp, washed ashore, and on mud-flat.	LOCALITY: ONEHUNGA BEACH & FORE SHORE, TO, CLIFS AT FAR END. observed by W. Lee-Pike. 21st, Nov 1953.
Habitat: sandy mud, alive.	**LOCALITY: main KARORE BANK. observed by Mr A. H. White. 14th Feb, 1954.**

Fig. 1. Sample page from the survey book p.14.

The pages of the book have been numbered to allow a computer file of the contents to be made, including an index. Where the book does not indicate whether the species was alive or dead, we have assumed it was dead. A few comments e.g. common, are recorded in the species list, but there is insufficient abundance data to use statistically or for direct comparision with localities today. Species names have been up-dated to Spencer et al. (2010), (see species list). It is interesting to note that many names in use then are the current names now, despite having undergone changes in the interim e.g. the date mussel *Zelithophaga truncata* at the time of the survey and today, but *Lithophaga truncata* for a period in between.

Localities (Fig. 2)
These include the north coast from Whatipu to the Upper Manukau Harbour at Onehunga and to Wattle Bay near the south heads. It must be remembered that the winding metalled roads at that time made getting to localities slower and more difficult than on today's sealed roads. Habitat details, not included here, are given in the book, e.g. The small narrow limpet *Notoacmea scapha* lived on the leaves of the sea grass Zostera, pipi *Paphies australis* was buried just under the sand surface and the gastropod *Trichosirius inornatus* (Fig. 3) was living on the spiny tubeworm *Spirobranchus cariniferus.*

Te Tau Bank, situated offshore between Cornwallis and Laingholm, was a popular location, members visited it by launch four times between 1953 and 1963 (see the original article in this issue). It had a rich fauna including the helmet shell *Semicassis pyrum,* trumpet shell *Ranella australasia* and hairy trumpet *Cymatium parthenopeum.*

Although listed separately, Jenkins Bay, Titirangi, and "end of School Road" are the same location, the road has since been renamed South Titirangi Road. Mill Bay to Parau and Mill Bay to Big Muddy are also the same location. One location called "Mill Bay, near Onehunga wharf", does not appear on any recent, or historical maps. It seems likely that it was a locally used name. The only Mill Bay today is north of Cornwallis, it was near the location of the first steam-driven mill in New Zealand. Extensive development for the south-western motorway since the survey has reclaimed the major part of Onehunga Bay. Further reclamation is currently being planned.

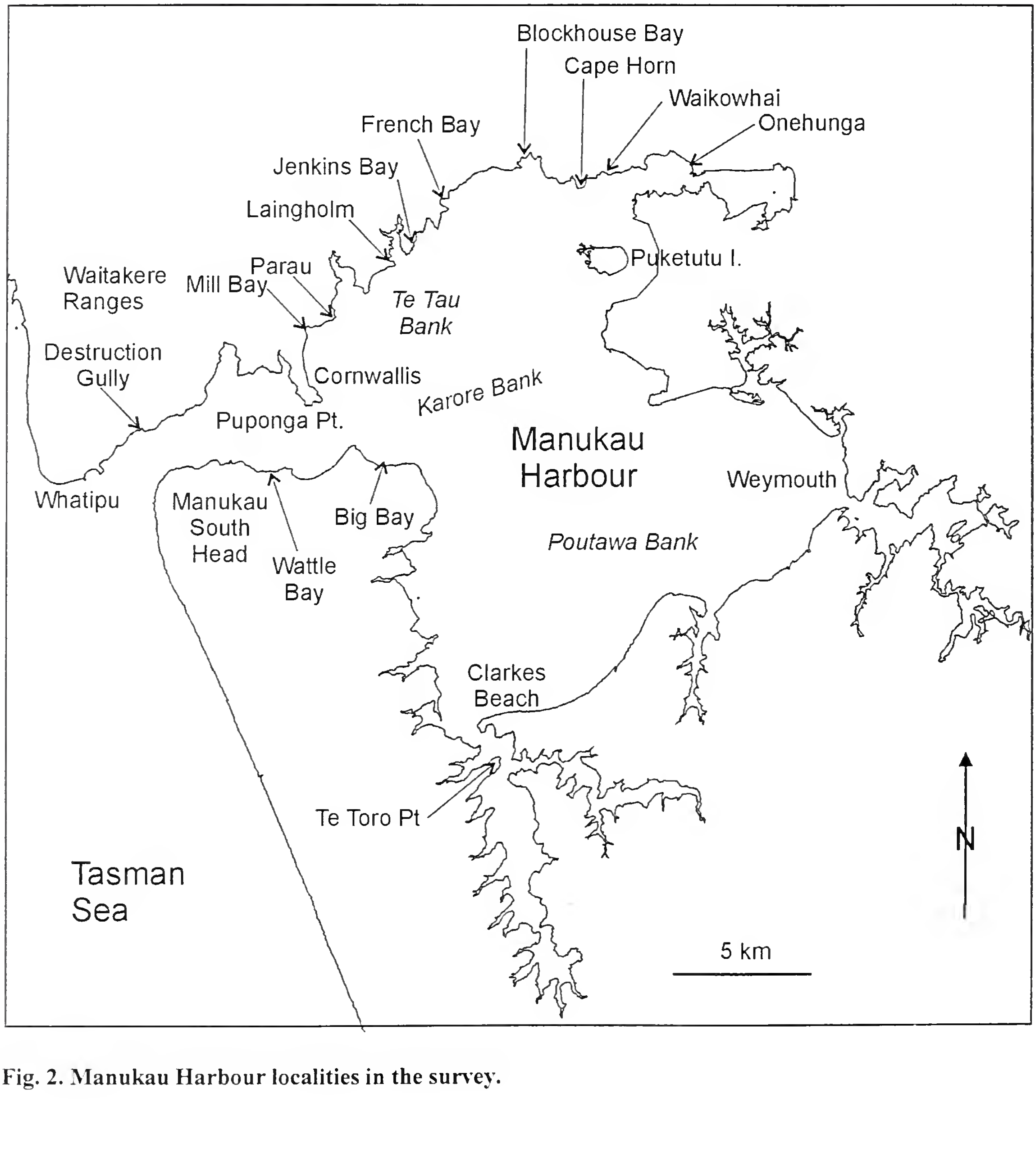

Fig. 2. Manukau Harbour localities in the survey.

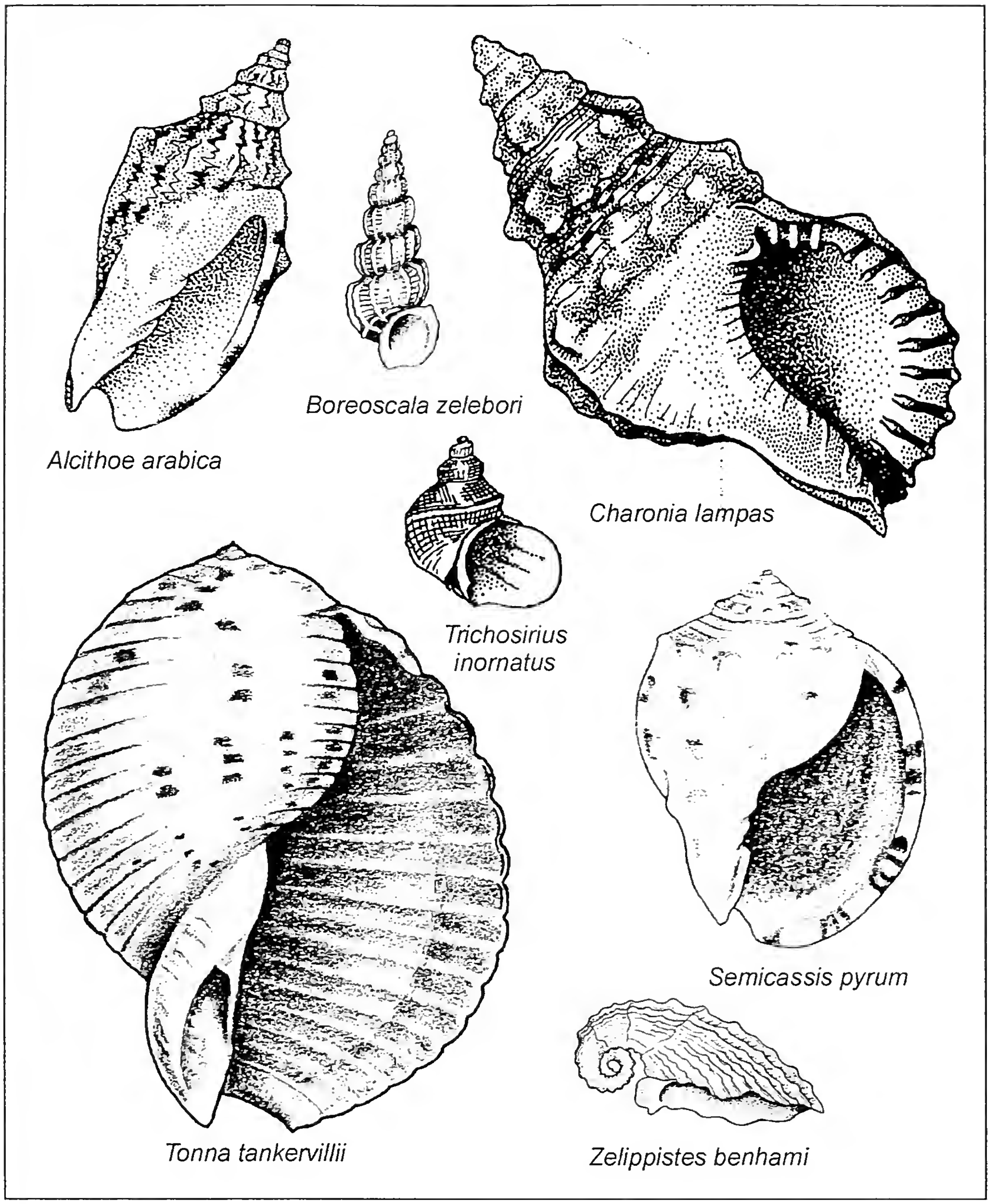

Fig. 3. Species recorded in the 1950s-60s survey of the Manukau Harbour, apparently not present today. ***Semicassis pyrum, Tonna tankervillii Zelippistes benhami, Trichosirius inornatus, Charonia lampas, Alcithoe arabica, Boreoscala zelebori.***

Observers (see Table 1)

Although most observers of each species are recorded, few Christian names are given. Bulletin numbers 8-17 published from 1952-1961 by the Conchology Section of the Auckland Museum include lists of members which have been used to confirm gender, spelling and initials. Bulletins were journals published before Poirieria. Problems arise because, following the custom of the day, the wife used her husband's initials. For example W.P. Thomson may mean either husband or wife as they were both members.

The observer is recorded for most locations but not all. The most frequent observers were Mr and Mrs Thomson, Ken Hipkins, William Lee-Pike and Albert Jones.

The following are snippets of information that have been traced or remembered. Please contact the authors if you know of any corrections or additions.

Ken Hipkins was president of the Section from 1957-61, he was a frequent author in several Bulletins and many newsletters (e.g. Hipkins 1957, 1958).

Albert Jones was also a knowledgeable contributor to the Bulletins and newsletters (Jones unpublished 1953). He gave a talk to the Conchology Section on collecting at Whatipu and wrote notes and species lists of his collecting (Jones 1953). He was also a keen fisherman.

Arthur White came from Howick, selected specimens from his extensive collection are in the Auckland War Memorial Museum marine collections (Morley et al. 2001).

Syd Hulme was a keen schoolboy member, who later became a micropaleontology technician in the Geological Survey, Lower Hutt, where he was tragically drowned in 1962 while testing his own design of underwater breathing equipment in Wellington Harbour (Hornibrook, 1962). He gave the Conchology Section talks, e.g. sample plotting and methods of housing collections (unpublished).

Bill Rudman, well known for his work on Opisthobranchs, is currently a senior molluscan researcher at the Australian Museum, Sydney.

The late Norman Gardner was a long time member of the Conchology Section. With his wife, Noel, he was co-editor of Poirieria (1952-1981) and President of the Conchology Section (1954-1956), (Morley et al. 2009).

Stan Turner lives at Mount Albert where he still cares for his shell collection. The Turner family have owned a bach at Huia for 34 years. Stan used to work for Turners and Growers in the Auckland markets. He haunted the trawler berths nearby every day to ask the skippers for shells. Stan, Baden Powell and Norm Gardner used to go on shelling trips together. He has vivid memories of the millions of *Zethalia zelandica* on the Te Tau Bank. He used to exchange shells with the owners of the Paua house in Bluff.

Alma Morgan was a keen out of town member who attended field trips and contributed to the Bulletins. She was assistant secretary of the club.

Mrs Joyce Wyatt lived at Mt Eden where she had a big collection, which she later presented to the club. It was sold at auction and used to finance a special memorial Bulletin.

Mr and Mrs W.P. Thomson lived in the Bay of Plenty. Nancy Smith has some of his shell cabinets which he made himself. Some deep-water shells in his collection came from Mt. Maunganui trawlers.

Albert Brooke's collection

It is thought that some Manukau survey specimens were put in the Albert Brookes collection, which was purchased by the Conchology Section after his death in 1955. Albert, a Matamata farmer, was an avid collector of both molluscs and Coleoptera beetles. He described and illustrated some new beetle species. DSIR purchased his insect collection for $1000. His New Zealand shells were housed in the Conchology Section meeting room at the Auckland War Memorial Museum for many years, where they were made available to members (Derrick Crosby pers. comm.). When this room succumbed to museum redevelopment in 1989, this collection was auctioned by the Section (Nancy Smith pers. comm.). The family presented over 3000 overseas molluscan lots from the Brookes collection, including 5 holotypes, and over 2000 land snails to the Auckland Museum. Only 6 Manukau Harbour lots from the Brookes collection show in Auckland Museum computer searches, more may be present but have not yet been put into the database.

Identification problems

Not many of the specimens from the survey are available to confirm doubtful identifications. It is occasionally stated in the book that a specimen is in a member's collection but most of these have long become untraceable. Of those known, Ken Hipkins' extensive collection was sent to Winston Ponder at the Australian Museum and Lorna Seagar's collection went to Derrick Crosby. Several species cannot be identified with certainty because research since the 1950s has described new species. The small limpet identified in the book as *Notoacmea helmsi* is now interpreted as a

synonym of *N. elongata*; or the survey specimen may be a recently described species, *N. potae* which is recorded from Cornwallis by Nakano et al. (2009).
Marshall (1998) has resurrected from synonomy the name *Cantharidus huttonii* for the small trochid in sheltered locations with C. *tenebrosus* living on more open coasts. Since the survey specimens were found within a harbour, the commoner *C. huttonii* seems the more logical choice.
The slipper limpet known then as *Maoricrypta monoxyla* has since been split by Marshall (2003) into *M. sodalis,* living within a gastropod shell inhabited by a hermit crab, and *M. monoxyla* retained for the species attached to the outside of shells. Judging from the habitat descriptions it appears both species were present.
The small slug *Melanochlamys* sp.(as *Aglaja* n.sp.) found by Ken Hipkins at Mill Bay crawling among sea grass *Zostera* in 1954, is especially intriguing. Since the animal of the commoner species *M. cylindrica* is black, did Ken find the pale species *M. lorrainae* which was not described until 1968 (Rudman 1968)? Both these *Melanochlamys* species have similar, fragile internal shells rarely seen in collections. The pale species, not seen for 40 years, was rediscovered in 2006 at Wattle Bay near the South Manukau Heads. Molecular analysis confirms that *M. cylindrica* and *M. lorrainae* are genetically distinct (Krug et. al. 2008).
The identity of the nudibranch listed as *Aeolidia gracilis* from Jenkins Bay, Titirangi, remains unclear. This species is recorded by Powell (1979, p 290) as *Aeolis gracilis,* which is no longer recognised. Bright red tentacles and papillae, prominently tipped with white are part of Kirk's original description, this might correspond with what we now call *Phidiana milleri* (Richard Willan pers. comm.) which is known today from Paratutae, Whatipu.

Changes since 1950s
Some species in the 1950s-1960s survey have not been found by us living in the Manukau Harbour during our surveys since 2000. These include the helmet shell *Semicassis pyrum*, trumpet shell *Charonia lampas,* volute *Alcithoe arabica,* wentletrap *Boreoscala zelebori, Zelippistes benhami* and *Trichosirius inornata* (Fig. 3). A total of twelve specimens of *Charonia lampas* (both rubicunda and capax forms) are recorded as being collected below low tide off Puponga Point between 1954 and 1958. One measured 190 mm by 133 mm (Jones 1958).
One major agent of change has been the arrival of the introduced Pacific oyster *Crassostrea gigas* (Dinamani 1971), (Fig. 4). The oyster is now a dominant species initially attaching to intertidal rock or cockle shells. When it is well established, dead shells become scattered across previously sandy beaches, providing more attachment for the oysters. Residents at Waikowhai recall running and swimming as children at a sandy beach, which is now covered in sharp oyster shells. Wherever the oysters *C. gigas* grow in profusion they are accumulating mud around them and are thus contributing to further environmental changes and reduced clean intertidal habitat for other species (Hayward 1997).

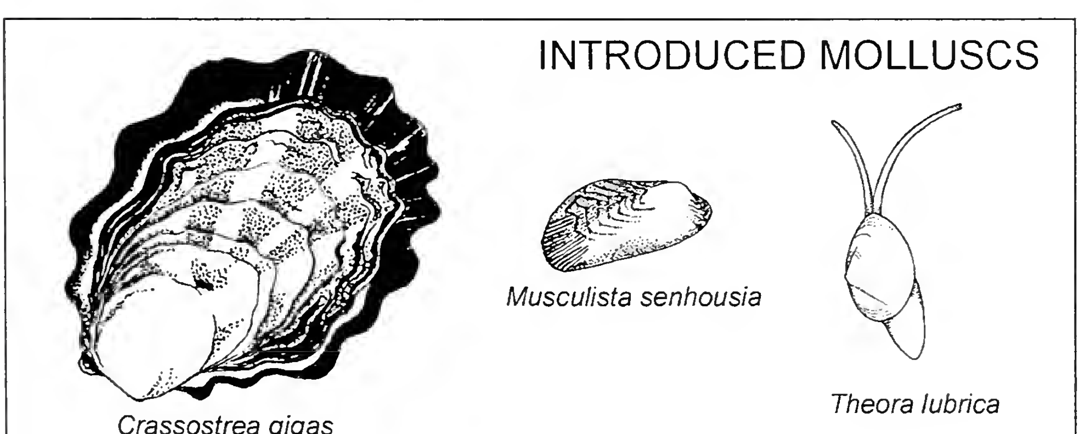

Fig. 4 Introduced species that have arrived in the Manukau Harbour since the 1950's.

As well as the Pacific oyster the introduced Asian mussel *Musculista senhousia* and the small semelid bivalve *Theora lubrica* (Fig. 4) have also arrived in the Manukau Harbour since the 1950s-60s survey (pers. obs.). Thickets of *M. senhousia* accumulate mud which temporarily smothers extensive areas of low tidal and shallow subtidal areas (Hayward 1997). After two years the mussels die, the mat breaks up and the next recruitment often establishes elsewhere.

Other reasons for changes in the fauna are complex, probably a combination of several factors. Fine silt run-off from land development smothers marine fauna, heavy metals in road run-off affects mollusc health. The biocide tributyl tin (TBT) was widely used as an antifouling paint for the hulls of ships and pleasure craft until it was banned in 1989. Research shows that TBT causes imposex, which in severe cases prevents reproduction, particularly in neogastropods (Stewart et al. 1992). Dramatic impacts have been shown in the Waitemata Harbour on *Haustrum* spp., Muricidae, Olividae and Buccinidae (Jones 1992). No doubt similar effects have occurred in the Manukau Harbour.

The sewage treatment plant inside Puketutu Island was established in 1960 bringing with it the largest freshwater input into the Manukau Harbour. The input has grown in size with the growth of the city. This increased brackishness in the upper harbour, especially in the Mangere Arm, has had major impacts on the modern foraminiferal fauna (Matthews et al., 2005) and presumably also on molluscs in this part of the harbour.

Many species of micromollusc can be sieved from seaweed or washed from low tidal rocks today (Hayward and Morley, 2004) but only a few are recorded in the 1950s-60s survey. These must have been present then but would only been found during targeted searches. This omission is surprising since Ken Hipkins specialised in micromolluscs. He published several papers on various microscopic families illustrated with detailed drawings (Hipkins, 1955). Numerous bright orange nudibranchs from Jenkins Bay, Titirangi were found by the authors (BWH, MSM) at low tide among a soft coral *Alyconium auranticum* in November, 2008. These were identified by Richard Willan as *Hoplodoris nodulosa.* This outstanding species is not recorded in the earlier survey.

Discussion

The chiton *Acanthochitona zelandica* appears to have taken advantage of a new habitat. In the earlier survey they were found under intertidal rocks or among seaweed at all locations. (Fig.1) Today *A. zelandica* is found almost exclusively in the Manukau Harbour in introduced clumps of *C. gigas* (pers. obs.) which were not present back then. It is likely that specimens moved up to avoid being smothered by the increase in mud at beach level. A similar change of habitat has occurred with *Risellopsis varia* which is recorded among Zostera in the book but now lives among *C. gigas* clumps.

Table 1. Mollusc species records from the Manukau Harbour, made by Conchology Section members between 1952 and 1963.

Localities

A. Whatipu A.H. Jones separate list 1952, plus book records 3 Jan 53, 11 Apr 59 [AJ]
B. Destruction Gully 3 Jan 53 [AJ]
C. Puponga Point 1 Jan 52, 7 Sept 52, 26 Sept 53, 6 Oct 56, 24 Aug 57, 1958, 19 May 59 [HC, AH, SH, AJ]
D. Cornwallis 3 Jan 53, 26 Sept 53, 24 Nov 53, 29 Dec 55, 21 Oct 57 [GB, AH, SH, AJ, LP, WP, WY, JW]
E. Mill Bay 4 Sept 52, 13 Nov 54, 25 Apr 55, 9 Sept 55, 6 Oct 56, 24 Aug 57 [GB, NG, AH, SH, AJ, LS, WT]
F. Mill Bay & Parau 26 Sep 53 [AH, LP, WT, JW]
G. Parau Bay south side 4 Sep 52 [AH]
H. Te Tau Bank A. H. Jones separate list plus book records from 2 Jan 53, 16 Mar 57, 17 Mar 61, and 63 [GB, AJ, AM, LP, WR, ST, WT]
I. Laingholm 24 Oct 53 [WT]
J. Jenkins Bay, School Rd., Titirangi, 20 Sept 52, 29 Sept 53 [NG, AH, WT, JW]
K. French Bay, Titirangi 29 Dec 52 [WT]
L. Blockhouse Bay 9 Aug 52 [AH, SH, AJ, WT]
M. Cape Horn /Puketutu bank between, 28 Apr 53, 10 Nov 53 [AJ, WT]
N. Waikowhai 12 Feb 55
O. Onehunga 21 Nov 53, 12 Dec 57 [AH, AJ, LP]
P. Mill Bay near Onehunga wharf 20 Sept 52, 7 Jul 53 [AJ, LP]
Q. Puketutu Id. 23 Apr 59
R. Karore Bank 14 Feb 54 [AW]
S. Weymouth 13 Apr 57 [PH, WT]
T. Clarkes Beach no date
U. Te Toro Point offshore Mar 56 [LS, WT]
V. Big Bay, Poutawa Bank 1958 [AJ]
W. Wattle Bay A.H. Jones separate list 52 plus book records 26 Dec 52 [AJ, WT]

Key to observers' initials

AH A.K. Hipkins (Ken)
AJ Albert H. Jones
AM Alma Morgan
AW Arthur H. White
GB Grant Bawden
HC H.J. Chapman Mr
JW Joyce Wyatt
LP W. Lee-Pike (Bill)
LS Lorna Seagar
NG Norman Gardner
PH P. Hutton Mr
SH S. Hulme (Syd)
ST Stan Turner
WR W. Rudman (Bill)
WT Mr and Mrs William P. Thomson

d = dead, l = live, c = common, *taken by divers

Present species name	**Name in book 1950s-60s**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**
Polyplacophora																								
Acanthochitona zelandica	*A. zelandicus*	1	1		1		1			1	1		1							1				
Chiton glaucus	*Amaurochiton glaucus*	1	1	1		1			1	1	1		1											
Cryptoconchus porosus		1		1			1																	
Eudoxochiton nobilis		1	1																					
Ischnochiton maorianus		1	1		1		1		1	1														
Leptochiton inquinatus	*Terenochiton inquinatus*						1			1	1	1												
Notoplax mariae										1	1													
Onithochiton neglectus		1																						

Present species name	Name in book 1950s-60s	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Plaxiphora biramosa	*Diaphoroplax biramosa*	l	l																					
Plaxiphora obtecta	*Guildinia obtecta*	l	l																					
Rhyssoplax stangeri	*Acanthochiton stangeri*				l																			
Sypharochiton pelliserpentis		l		l		l			l	l	l		l											l
Sypharochiton pelliserpentis	*Sypharochiton sinclairi*					l																		
Bivalvia																								
Acar sandersonae		d																						
Atrina zelandica					l	l			l										d					
Austrovenus stutchburyi	*Chione stutchburyi*	d				l				l			l			l								l
Barbatia novaezelandiae					l																			
Barnea similis	*Anchomasa similis*															d								l
Borniola reniformis	*Rochefortula reniformis*				l																			
Cardita aoteana		d																						
Circomphalus yatei	*Bassina yatei*	d							l *															
Cleidothaerus albidus	*C. maorianus*			l			l	l		l														
Crassula aequilateralis	*Spisula aequilateralis*	d																						
Cyclomactra ovata	*Mactra ovata*				d				d				d	d		c								d
Diplodonta striatula	*Taras zelandica*				d																			
Divalucina cumingi	*Divaricella cumingi*	d		d					d															
Dosina zelandica		d																						l
Dosinia anus		d							l															
Dosinia lambata									d															
Dosinia subrosea					d				d															l
Gari lineolata		d							d															
Hiatella arctica	*H. australis*	l			l																			
Hunkydora novozelandica	*Thracia vitrea*								l															
Irus reflexus	*Notirus reflexus*			l		l																		l
Lasaea hinemoa													l											
Lasaea maoria					l																			
Leptomya retiaria									l *															
Limnoperna pulex	*Modiolus neozelanicus*									l	l		l			l								l
Limnoperna securis	*Modiolus fluviatilis*															l						d		
Linucula hartvigiana					d				l	l			d			d								
Macomona liliana		d							l	l			d			l								l
Mactra discors		l								l														
Modiolus areolatus					d																			l
Musculus impactus		d			d		l			l	l													l
Myadora boltoni																								l
Myadora striata					l		l		d															l
Offadesma angasi									d					d										d
Ostrea chilensis	*Ostrea sinuata*				l		l		l		l					l	l		l					l
Panopea zelandica																							d	
Paphies australis	*Amphidesma australis*	d			d	l				l	l		l			l								l
Paphies subtriangulatum	*Amphidesma subtriangulata*	l							l															
Pecten novaezelandiae	*Notovola novaezelandiae*	d			l	l	l	l	l		l								l				c	d
Perna canaliculus	*Mytilus canaliculus*	d		l	l		l			l	l													l
Peroneae gaimardi	*Angulus gaimardi*	d																						
Pratulum pulchellum	*Nemocardium pulchellum*																							
Protothaca crassicostata		d																						
Ruditapes largillierti	*Paphirus largillierti*				l		l		l *	l	d			d										l
Saccostrea cucullata glomerata	*Saxostrea glomerata*							l										l						
Serratina charlottae	*Tellina ferrari*																							d
Solemya parkinsonii	*Solemya parkinsoni*			d					d										d					
Soletellina nitida															d									
Talochlamys zelandiae	*Chlamys zeelandona*	d			l																			

Present species name	Name in book 1950s-60s	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Talochlamys zelandiae	*Chlamys zelandiae*	l		l		l																		
Tawera spissa		d							d															
Zelithophaga truncata						l				l	l													
Zenatia acinaces									d					d										d
Scaphopoda																								
Antalis nana	*Dentalium nanum*	d									d												d	
Gastropoda																								
Aeolidia ? sp.	*Aeolidia gracilis*					l																		
Aethocola glans	*Austrofusus glans*	d							d															
Alcithoe arabica		d		l					c					l									l	l
Alcithoe arabica	*Alcithoe swainsoni*	d							l *												d			
Amalda australis	*Baryspira australis*				d				l							l				d				l
Amalda mucronata		d																						
Amalda novaezelandiae	*Baryspira novaezelandiae*								d															
Amphibola crenata		l				l										l						d		
Antimelatoma buchanani maorum		d																						
Argobuccinum pustulosum tumidum		d																						
Assiminea vulgaris				l																				
Austrolittorina antipodum	*Melarhaphe antipodum*			l							l		l											l
Austrolittorina cincta	*Melarhaphe cincta*				l						l		l											
Austromitra rubiginosa				l																				
Berthella ornata	*Bouvieria ornata*						l																	
Boreoscala zelebori	*Cirsostrema zelebori*	d									d													
Buccinulum linea	*Buccinulum multilineum*						l		l	l	l									l			l	l
Buccinulum vittatum	*B. heteromorphum*	l		l			l			l	l												l	
Buccinulum vittatum		d																						
Bulla quoyii	*Quibulla quoyi*								d															
Cabestana spengleri		l					l			d	l									l				
Cabestana tabulata	*Cabestana waterhousei*					l																		
Calliostoma punctulatum	*Venustas punctulata*	l	l		d				d															d
Calliostoma tigris	*Maurea tigris*	l	l		l																			
Callistoma selectum	*Maurea cumminghami*	d							d															
Cantharidus huttonii	*Micrelenchus huttoni*						l		l															
Cantharidus sanguineus	*Micrelenchus sanguineus*			l																				
Cantharidus tesselatus	*Cantharidella tesselata*	l																						
Cellana denticulata		d																						
Cellana ornata		l																						l
Cellana radians		l																						l
Cellana stellifera		l																						
Charonia lampas	*Charonia rubicunda*	l *		l																				
Chemnitzia zelandica		d																						
Coelotrochus tiaratus	*Trochus tiaratus*	l							l *															
Cominella adspersa		l				l			l															l
Cominella glandiformis						l			l	l	l		l											l
Cominella maculosa							l			l	l		l							l				l
Cominella quoyana				d																				
Cookia sulcata		l *		l																				
Cymatium parthenopeum	*Monoplex parthenopeum*						l	l	l	l	l												l	l
Dendrodoris citrina						c																		
Dentimargo cairoma	*Marginella cairoma*				l																			
Dicathais orbita	*Neothais scalaris*	l					l			l	l													l
Diloma aethiops	*Melagraphia aethiops*	l				l				l	l		l							l				l
Diloma bicaniculata	*Anisodiloma lugubris*	l																						

Present species name	Name in book 1950s-60s	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Diloma bicaniculata	*Anisodiloma lugubris*			d					d															
Diloma coracina	*Caridiloma coricina*	1																						
Diloma subrostrata	*Zediloma subrostrata*					1			1				1									1		1
Diloma zelandica	*Zediloma atrovirens*	1		1																				
Eatoniella olivacea	*Dardanula olivacea*				1				1				1											
Eatonina micans	*Notosetia micans*								1															
Epitonium jukesianum					d																			
Epitonium tenellum					d																			
Haliotis australis	*Notohaliotis australis*	1		1	1																			
Haliotis iris		1	1		1																			
Haliotis virginea		1																						
Haminoea zelandiae					d		1		1	1			d	1										1
Haustrum haustorium	*Lepsia haustrum*	1				1	1																	
Haustrum scobina	*Lepsiella scobina*	1			1					1	1		1				1							1
Haustrum scobina	*L. scobina albomarginata*					1				1			1				1			1				1
Janthina exigua		d																						
Janthina janthina	*Janthina violacea*	d																						
Lamellaria ophione				1						1		1												
Leuconopsis obsoleta				1							1		1											
Lunella smaragda		1				1				1	1		1											1
Maoricolpus roseus manukauensis		d			d		1		d	1	1									d				1
Maoricrypta monoxyla?																				1				
Maoricrypta sodalis?	*Maoricrypta monoxyla*						1		1											1				
Marinula filholi				1	1						1													
Melanochlamys cylindrica	*Aglaja cylindrica*					1																		
Melanochlamys n. sp.	*Aglaja n.sp.*					1																		
Microtralia occidentalis	*Rangitotoa insularis*				1																			
Neoguraleus amoenus		d																						
Neoguraleus manukauensis						c					1													
Neoguraleus oruaensis						c					d			d										
Nerita melanostragus		1	1		1																			
Notoacmea helmsi				1		1	1				1		1			1								
Notoacmea parviconoidea																								1
Notoacmea pileopsis		1	1	1																				
Notoacmea scapha						1																		
Notoacmea scopulina		d																						
Ophicardelus costellaris					1																			
Patelloida corticata		1	1	1																				1
Penion sulcatus	*Penion adjusta*	d			1	1	1	1	1	1	1												1	
Pervicaia tristis		d			d									d										d
Phenatoma rosea	*P. nova-zelandiae*																							
Phenatoma zealandica		d																						
Philine angasi									1															
Philine auriformis						d																		
Pisinna sp.	*Estea sp.*								d															
Potamopyrgus antipodarum	*Potamopyrgus antipodum*						1						1											
Radiacmea inconspicua		1	1																					
Ranella australasia	*Mayena australasia*						1	1	1		1												1	1
Risellopsis varia													1											
Rissoina chathamensis									1															
Scutus breviculus				1			1				1													
Semicassis pyrum	*Xenophalium pyrum*	d							1															
Sigapatella novaezelandiae				1			1		1	1	1									1				
Sigapatella tenuis	*Zegaleus tenuis*				1				1		1													1
Siphonaria australis	*Siphonaria zelandica*	1		1							1		1											1
Struthiolaria papulosa		d				1	d		1 *										1				1	1
Struthiolaria vermis		d			d		d		1					1										1
Suterilla neozelanica				1																				
Taron dubius							1				1													
Tonna tankervillii	*Tonna haurakiensis*	d																						

Present species name	Name in book 1950s-60s	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
Trichosirius inornatus					d				d		l									d				
Trimusculus conicus	*Gadinalea nivea*	d																						
Tugali elegans		l																						
Tugali suteri				l																				
Xymene ambiguus	*Zeatrophon ambiguus*	d																						
Xymene plebeius	*Xymene plebejus*				d		l		l	l	l													
Xymene traversi	*Axymene traversi*			l																				
Zeacolpus cf. ahiparanus		d																						
Zeacolpus pagoda	*Zeacolpus fulminatus*	d																						
Zeacolpus vittatus		d																						
Zeacumantus lutulentus		d				l				l	l					l								l
Zeacumantus subcarinatus						l				l	l		l				l							
Zethalia zelandica									c										d					
Cephalopoda																								
Octopus maorum		l																						
Spirula spirula		d											d						d					

Norman Douglas's Manukau Harbour collection

Although the book does not record sizes, members who were fortunate enough to have seen the late Norman Douglas's Manukau Harbour collection will recall not only the wide range of species present, but also their excellent condition and large sizes, when compared to those seen today. Although Norman was actively collecting during the survey his main interest at that time was deer (Stan Turner pers. comm.). His name does not appear in the book. Norman's wife Lorna has this collection in her home at Waiuku. It will eventually go to their son Murray who keeps up the family interest in natural history by designing radio transmitters to track native birds (Glenys Stace pers. comm.). Most of Norman's main New Zealand collection went to the National Museum, Te Papa.

Conclusion

This data from the book and unpublished papers will be invaluable for comparison when the current long-term survey by the authors (BWH, MSM) is completed. Many species from the 1950's are still present in Manukau Harbour, but smaller inconspicuous species will require careful searching of their specific habitat. e.g. *Microtralia occidentalis* under high tide stones. These species and locations could be useful goals for future Shell Club field trips.

Acknowledgements

We thank Conchology Section members of the 1950's, who documented their field trips, especially Albert Jones for typing his separate species lists; Stan Turner, a member of the survey who recalled memories, and his daughter Elizabeth Logan; Derrick Crosby, Derek Lamb, Alan Petersen, Peter Poortman, Nancy Smith, Doug Snook, Glenys Stace, Fiona Thompson and Richard Willan who suggested contacts and searched their memories throwing light on observers and their collections. Richard also identified the *Hoplodoris nodulosa* and traced the *Aeolidia* species. Jenny Riley, technician in the Museum Marine Department in late 1980s-mid 1990s provided dates and gave advice. Thanks to Rosa Tyson for search ideas; Wilma Blom (Auckland Museum) for computer searches; Ashwaq Sabaa (Geomarine) for scanning drawings and page 14 of the book; and very importantly, to Gladys Goulstone for recognising the valuable find among old papers in the library.

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CONTENTS

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EDITORIAL

Patricia Langford

Dear Fellow Conchologists,
It has been a significant year for the marine environment, with notable turbulent weather patterns, ongoing debate about climate change, and closer to our own interests, the worrying changes occuring at our National Museum, Te Papa. The worldwide trend to popularise Museums has been underway for a number of years, and I suspect the box office success of such movies as "Night at the Museum" and its sequels has accelerated the changes. Indeed, our own Auckland Museum regularly offers night events and entertainment.

My first experience of attracting the masses to Museums happened in the year 2000 whilst I was travelling in Western Canada. A significant Museum housed a collection of notable artefacts from various "First Nations" cultures. The entrance fee led me to have certain expectations. Each room of displays was almost totally dark, with a central spotlight highlighting a clown or circus performer, backed by loud intrusive music. When I complained and expressed disappointment to a duty officer, clad in Mountie-style uniform, he explained that Canada was renowned for its "Cirque du Soleil" performances, and Museum directors had decided to use that theme to make their Museum a fun place to visit!

Similar irritation and disillusionment followed me on a visit to the excellent Art Gallery in Adelaide in South Australia, where I was attempting to contemplate the outstanding colonial-era paintings,in peace and quiet. Unbelievably, a man chatting loudly on a mobile phone followed my every move, and when I appealed to staff they declined to intervene. Even our City Libraries have been instructed to become "Commmunity Centres" with increasingly diverse noisy activities, but I will not comment further on that.

To return to policy changes at Te Papa. Decision makers have a duty to put aside personal preferences for promoting The Arts, popular and theme park-style entertainments, for the core business of housing and maintaining scientific study collections and appropriate staff, which are Taonga in their own right, and of no lesser importance than any other category of Museum collections. Earthquake excuses aside, natural history collections and associated knowledge are the very foundation of our unique maritime Nation, and our indigenous flora and fauna, embracing abundant marine life and distinctive landscapes, are the main attractions that brought both early and recent migrants to our shores.

Hallowed halls aside (or abandoned) what kind of message or inspiration are we sending to our young aspiring scientists of the future? We will surely need them more than ever - trade, tourism, economic diversity, fisheries, agriculture, natural resources - all increasingly under stress and insatiable demand. I am all for a balanced life experience, including the inspiration of real art and music, but education and scientific knowledge are also power tools for human survival.

This touching recollection of the 1950's modus operandi of the late great Dr.AWB Powell, I share with you all. Apparently the esteemed Auckland Museum Conchologist (and artist) regularly visited the Shell Galleries after school hours on week days. He sometimes spotted an earnest admirer of the displayed specimens, and they would be persuaded to join the Museum Conchology Section as a Junior member. Some of those youngsters went on to notable careers in Marine Science.

NOTE: A SUB-FOSSIL FORM OF *PECTEN NOVAEZELANDIAE* FROM OAKURA, NORTHLAND

Michael K. Eagle

Powell (1979: 377) states that: "The genus *Pecten* [Müller, 1776 (= *Notovola* Findlay, 1927)] is a late comer to New Zealand, evidently having spread from the Mediterranean via the former Tethys Sea, reaching here during the Pliocene and Pleistocene." Beu *et al* (1990: 335) declare the earliest record of *Pecten novaezelandiae* Reeve, 1853 (= *Pecten kupei* Fleming, 1957) to be at Cape Kidnappers where it is more than a million years old. They also state that *P. novaezelandiae* is known from New Zealand since at least oxygen isotope stage 13, "probably equivalent to Upper Kai-Iwi Siltstone at Castlecliff," (c.0.34 million years).

A Pleistocene form of *P. novaezelandiae* out-washed from an exhumed shellbed on the banks of Oakura Stream, Oakura Bay, Northland (Fig.1), with similar shell morphology to the sub-species *rakiura* assigned by Fleming (1951: 130; 1957: 44), was collected in October 2012. The specimen has squarer ribs, deeper narrow interspaces, is a uniform light brown colour, has intercostal lamellae, is slightly reduced in inflation, with two left ribs on the convex right valve unnaturally enlarged and the sculpture secondarily radially bifurcated (Fig. 2A) in contrast to the more common form of *P. novaezelandiae* (Fig. 2B). Fleming (1951) nominated Stewart Island as the type locality of *rakiura*, but Powell (1979) noted "these characters are present to some extent in northern populations, so one can assume that they are part of the normal range of variation."

Fig. 1. Map showing '*P. novaezelandiae cf. rakiura*' sub-fossil locality, Oakura Stream, Oakura, Northland (representational only).

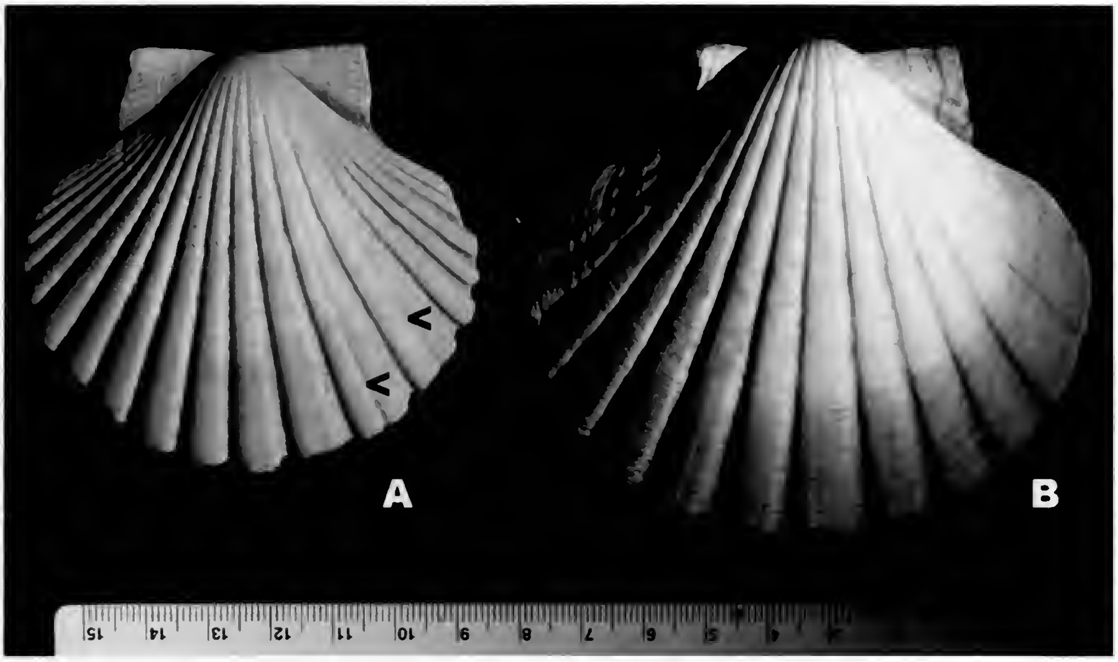

Fig. 2. Photograph of *P. novaezelandiae* forms for comparison: A. Oakura Stream subfossil specimen with two enlarged ribs radially divided (at <); B. Oakura Bay Recent beach-drift).

Oakura Stream incises a low-lying hinterland considered an infilled coastal swamp/paleo-estuary with various tempestite (storm accumulations) and beach-drift shell beds deposited in time and space. The endemic, edible *P. novaezelandiae* today lives on intertidal estuarine sand flats, in large bays open to the sea and on the inner continental shelf down to 30 (commonly) and 120 (rarely) metres. Consequently, *Pecten* fossil species are found fossil in shallow water beds only. The occurrence of sub-fossil *P. novaezelandiae* with *rakiura* characters in Northland supports the premise that this genetic form has longevity.

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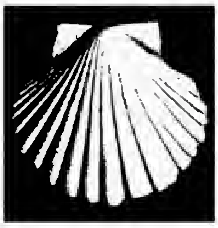

IN A WHORL WITH *COMINELLA GLANDIFORMIS*

Margaret S. Morley

Summary

The egg cases and development of the embryonic shells of *Cominella glandiformis* are described.

Introduction

For some years, Bruce Hayward and I have been building up marine species lists for Hauraki Gulf beaches during spring low tides. On October 17 2012, we were surveying Baddeley Beach, south of Leigh (Fig. 1). I collected a clump of oysters *Saccostrea cucullata glomerata* from mid-tidal rock faces because this habitat reliably provides several species (Powell 1979 p 49). The molluscs likely to be found include the chiton *Acanthochitona zelandica*, the bivalve *Lasaea hinemoa,* small gastropods *Leuconopsis obsoleta*, *Risellopsis varia, Fossarina rimata* and *Notoacmea* sp. As usual, after separating the clump, I looked at each surface of the oysters under the microscope. Other living creatures encountered on the oyster clump were a marine worm, its body hidden between the shells only its filtering tentacles on show; an ostracod and the smallest crab I have ever seen! On this occasion I was intrigued by five egg capsules attached to a dead oyster within the clump.

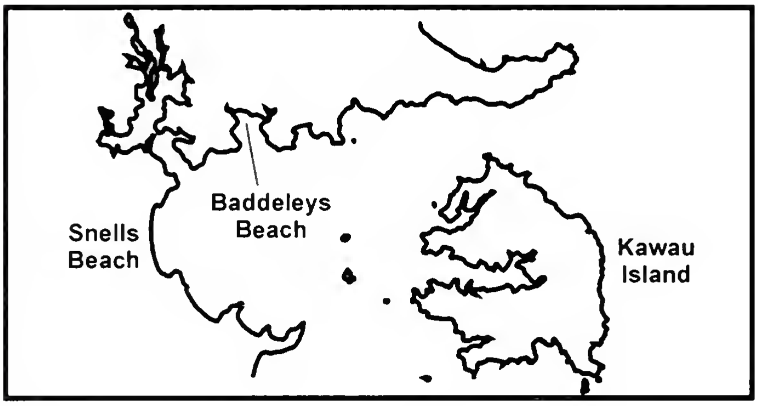

Fig. 1. Location of Baddeleys Beach, near Warkworth.

The Capsules

The five pyramid-shaped capsules, made of gelatinous translucent material, measured less than 2 mm in diameter. Each had a low profile, a shallow concavity at the top with three or four sharp reinforcing ridges running down to the base (Fig. 2). The capsules were continuous with the next where they were attached by a narrow, flat membrane to the oyster valve. Under the microscope about six grainy ochre-yellow blobs could be seen inside two of the five capsules.

The oyster valve was kept in seawater and daily progress checked under the microscope. There was little change for two weeks except that the yellow blobs appeared to be growing larger. The development of the embryos in capsule one was about a week ahead of capsule two which had five living animals moving inside. The adjacent capsules were empty.

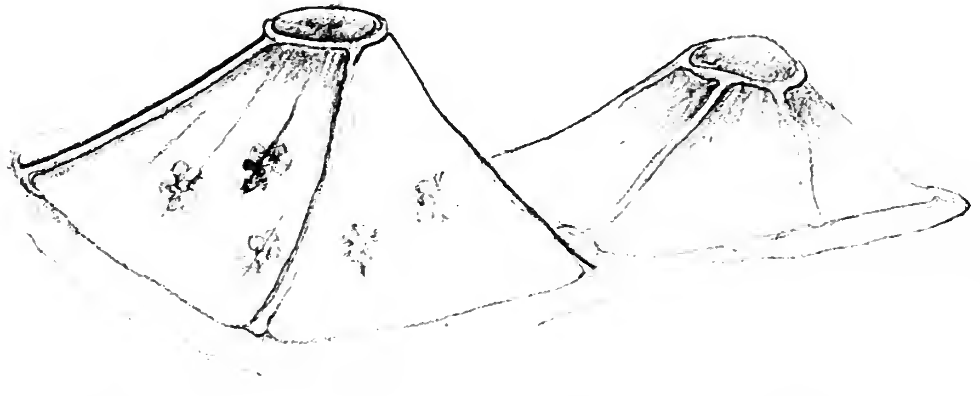

Fig. 2. *Cominella glandiformis* egg capsules, October 18, 2012. (3 mm full width).

Observation of the Development Stages

November 1 2012: Movements by each dark animal could be seen within its first whorl, its black eyes spots appeared to look up at me (Fig. 3). I had previously watched the development of *Pleurobranchaea maculata* spawn hatch into veligers with their wing-like velums edged with cilia (pers. obs.), but these were definitely protoconchs. This excluded molluscan species which have a planktonic stage. I was already familiar with the larger intertidal *Cominella adspersa* and *C. maculosa* egg cases so could rule out those, as well as the lined whelk *Buccinulum linea,* which lays collar-like egg cases around seaweed stems (Ian Scott pers. comm.). There were no matches among the carnivorous whelk egg cases illustrated in Gunson p. 86 (1993). I considered *Cominella quoyana quoyana* or maybe a turrid, but mid-tide seemed too high for these predominantly subtidal species.

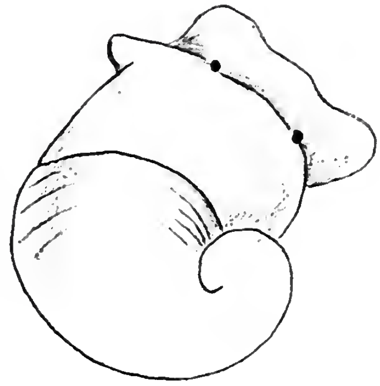

Fig. 3. *Cominella glandiformis* protoconch and animal, November 1, 2012 (0.4 mm across).

The animals responded to the microscope light and gentle prodding through the capsule by withdrawing or rotating on their foot. An anterior canal was starting to develop and a few compressed growth lines appeared on the outer lip of the second protoconch whorl.

November 2: The animals were growing larger within the capsule, though their food source was not obvious. The siphon could be seen.

November 3: The animals were medium grey with a fine darker reticulated pattern (Fig. 4). A current of sparkly white bubbles, possibly excreta, could be seen exiting the animal. The demarcation between the protoconch and first adult whorl was obvious (Fig. 5). The siphon now extended one third of the length of the shell. The foot, showing its phosphorescent margin, was clinging at times onto the inside of the capsule wall.

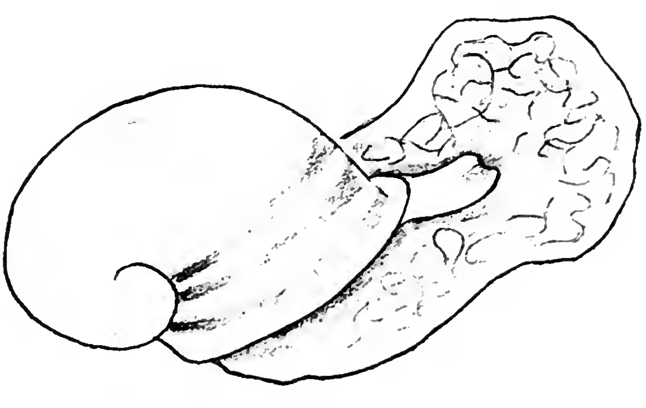

Fig. 4. *Cominella glandiformis* protoconch and animal, November 3, 2012. (0.7 mm long)

Fig. 5. *Cominella glandiformis* first adult whorls, November 30, 2012 (1.2 mm high)

November 4: Further shell growth showed cut-in sutures and incipient rounded axials developing. At this point I wondered if the egg cases were those of *Zeacumantus subcarinatus* so I examined adult specimens in my collection. However adult shells have the protoconch damaged or eroded off so cannot be used for comparision.

November 13: The embryos inside both capsules were growing. The capsule wall seemed to be thinner, is this a result of natural deterioration or is it being eaten?

November 22: Although the concave top of both the capsules was open the embryos were still inside.

November 30: The first capsule was empty and three animals remained inside the second capsule while a presumed fourth was found floating on the water surface. To my delight other embryonic shells were crawling either on the side of the container or among debris at the bottom. The largest was 1.2 mm. A single spiral was emerging towards the second half of the second protoconch whorl, two on the first adult whorl and three on the second body whorl (Fig. 5). The shell was dark tan brown. The animals were paler than in the earlier stages.

December 5: The animals crawled among detritus were not attracted to either a piece of pipi or seaweed. What do these juveniles eat?

December 7: The shells now have three adult whorls, the third with three fine, dark spirals.

December 15: Some of the shelled animals crawl on the goatskin label, has this acquired microbacteria or microflora e.g. diatoms?

December 17: I put a dead conjoined pipi shell covered in green film as a possible food source into the container. At this point disaster struck! Next morning my juveniles had disappeared, a search for the culprit revealed a well-satisfied crab inside the pipi shell!

Discussion

Identification Problems

Cominella glandiformis was suggested by Roger Grace. *Cominella* capsules (not specific to species), are grouped together in small sheets under stones, on stones, or hard cover forming pointed oval cases and fastened by short stalks (Morton and Miller 1968 p. 398). These capsules did not fit this description because they are broadly attached by the base with no stalk, though some support for mid-tidal *C. glandiformis* (Fig.6) was provided by the embryos surviving well, despite not being in aerated water and rising temperatures while I was away.

The horn shells *Zeacumantus lutulentus* and *Z. subcarinatus* were considered, but both lay soft gelatinous masses (John Walsby pers. comm.).

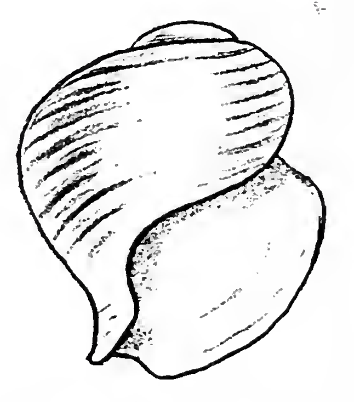

Fig. 6. *Cominella glandiformis* embryos Miranda, February 28, 2013. (1 mm high)

Another species which lays similar but taller egg cases is *Taron dubius* (pers. obs.) This possibility was ruled out because the Baddeleys Beach specimens developed with rapidly increasing whorls resulting in a tall narrow shell, nor was the animal red as in *T. dubius.* The capsules were not laid by *Haustrum scobina* as their egg capsules are circular (pers. obs.).

Developmental stages

Because the capsules were continuous, it is assumed that they were all laid at the same time, so different stages of development between capsules one and two are a puzzle.

Excreta

The bubbles were presumed specks of excreta. I have seen similar bubbles in other developing egg cases and spawn.

Food

Another unsolved problem is what do they eat? In the oyster borer, *Haustrum scobina*, 95% of the embryos break down to provide yolky food for the survivors (Morley 2004). This was not the case in this study as no embryos disappeared from the capsules. The capsule wall became thinner, is this the result of natural deterioration or is it being eaten from the inside by the embryos? If they don't eat the capsule is there a yolk supply which I did not see? In an effort to determine their food after they left the capsule I put a small piece of pipi and the seaweed *Codium fragile* into the container, but neither attracted the animals.

Spiral sculpture

Jack Grant-Mackie (2011) found a fossil egg case of the volute *Alcithoe arabica* still containing embryonic shells, these showed fine spirals on the second whorl of the protoconch. He states that adult shells are too worn or corroded for the spirals to be preserved, even if previously present. Embryonic shells of *A. arabica* in my collection, 0.5-0.8 mm from Mahurangi and Taranaki, have very fine spirals similar to those of *C. glandiformis* seen in this study. Possibly other embryonic shells of related species have them too. A future study would require collecting egg cases and observing their development.

Resolution

The Bioblitz at Miranda, Firth of Thames on February 28, 2013 finally solved the identification problem. The challenge was to find as many species as possible in 24 hours. The intertidal zone at Miranda is an extensive expanse of mud and sand flats, a single large log of wood seemed a likely place for additional species. It had been extensively bored by teredo *Bankia australis,* so I took some wood samples to check the bivalve and its pallets. Under the microscope at home, large numbers of the same familiar egg cases were attached to the surface of the wood. This time the only contenders were over two hundred *C. glandiformis* congregated around the log where they had laid their egg cases. Since few hard surfaces were available, egg cases had also been laid at the base of the occasional clumps of the seaweed *Gracilaria chilensis.* These egg cases were taller than the Baddeley Beach specimens and even piled up due to the lack of space on the narrow stems. One mm juveniles that I washed out from this seaweed are squatter and have much finer spiral sculpture than the Baddeley Beach specimens (Fig. 6). This appears to be a variable feature. Unfortunately the Miranda specimens only survived a few days so I was unable to follow the development of the adult whorls.

Acknowledgements

Thank you to Roger Grace and John Walsby who provided helpful discussions on possible identifications, information on the spawn of *Zeacumantus lutulentus,* and gave suggestions to determine the type of food eaten; and to Bruce Hayward for formatting the article.

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LITTLE KIWI BATTLER

Paul Leary

My wife, two young children and I arrived in Taipa late afternoon on the 1st of February 2013.

As a child I had spent my summer holidays in Taipa staying on the Adamson's farm in an old schoolhouse on their property. Having convinced my wife to travel all the way to the 'winterless' north with two children under the age of four, I would have preferred the weather to have been beautiful. However we were faced with days of wind, rain and rough seas. I did however harbour secret hopes for some decent wash-ups so had to find the right excuse to drag my family to a beach in the rain and wind. I decided my best chance was to use the experienced Doubtless Bay weather forecaster card, and confidently announced 'that even though it is raining here in Taipa it was bound to be fine on the other side of the peninsula'. I had no idea, but Rangiputa had to be my best bet.

When we arrived at Rangiputa, to my complete surprise, my rather hopeful prediction was right and weather conditions were indeed much better with the sun peeking through and little wind. I couldn't believe my luck. We headed around the far corner to the small bay that looks out to the open ocean. As soon as I hopped out of the car I could smell that familiar smell of a wash-up. The smell of rotting seaweed was quite strong and looking down the beach to the rocks I could see most of the beach was piled up with kelp. Let's just say my family weren't nearly as happy as I. The urge to dash straight down the beach and start scouring through the seaweed was almost overpowering.

Once we had our picnic arranged on the grass I sent my son Finlay off down to the beach to look for crabs and seized my opportunity to follow him and start riffling through the seaweed. After about 30 minutes of searching I was disappointed to find that despite a huge amount of seaweed there were very little shells of any interest. It appeared that the rough seas had only dislodged large stems of kelp that were attached to small rocks or the large dog cockle *Tucetona laticostata*. I eventually gave up and headed down to the rocks with the others to search for crabs; this proved to be far more fruitful.

On our way back to the picnic I was quickly scanning the kelp when I saw a yellow glint of what seemed to be an aperture of a shell poking up through the kelp. I reached down and quickly realised it was a very battered and broken hairy trumpet shell *Monoplex parthenopeus* with a five foot long stem of live kelp still firmly attached by its roots. The shell looked very old and worn, and the body whole was completely broken open (many years ago by the look of the extremely porous edges). I couldn't pinpoint why something didn't seem quite right about this battered old shell, but as it was very poor condition I threw it back down on the sand and started to walk away. It suddenly came to me that the internal structure of the shell was smooth and clean and looked just as it should for a living shell. I picked it up again and discovered that tucked up unusually high in the broken aperture was indeed a living mollusc. How on earth had this animal survived so long in a broken shell, let alone with five feet of kelp growing on its back?

That evening I pulled the shell out of the bucket to give it a closer examination. The back was almost entirely missing, and had clearly broken more than year or two earlier from the look of the corroded edges. It was battered and worn and covered with small pits from the saltwater eating into the shell. It was astonishing to see such an old battered and broken *Monoplex* still alive. This shell had somehow managed to shrink and contort its body up into the remaining area of protective unbroken shell. Amazingly it had continued to graze for food and stay alive whilst keeping away from predators. The next question I had was how did a long stem of kelp grow on the back? I could

see that the shell was not only very worn but was green with algae which suggested it may have been trapped amongst rocks. The beach was predominantly covered by kelp attached to algae covered rocks. It seems likely that the recent storm had caused the kelp to dislodge many of the anchors, including the *Tucetona laticostata* and clearly one battered but fighting *Monoplex parthenopeus*.

I can only conclude that after being smashed open by a previous storm it was then wedged tightly into a crevice which offered protection from predators. Remarkably it was then able to reduce its size to fit back up into the remaining shell, and survive on what little food was available immediately around it. The kelp grew over the years, anchoring around the shell and perhaps even protecting it from attack. Maybe, over the years, the kelp helped keep it fed by attracting food to the base of the stem in rather a symbiotic fashion.

Jammed between rocks and unable to move and eat oysters, broken and worn to half its normal size, this *Monoplex parthenopeus* was determined to survive, and managed to do so for a long while until this year's storm dealt a final blow. Even though this shell is not very pretty to look at, it now sits proudly in the front of my collection as an example of survival against the odds and well deserves the title of Little Kiwi Battler.

MOLLUSCAN RECORD OF EARLY HOLOCENE CONDITIONS AT BUCKLANDS BEACH, AUCKLAND

Bruce W. Hayward and Margaret S. Morley
Geomarine Research, St Johns, Auckland

Summary

Cemented basalt pebble conglomerate and coarse sand containing many shells forms beach rock at the north end of Bucklands Beach, Auckland. Many of the shells are the same as those living in the area today, but some layers are dominated by a thick-shelled assemblage of bivalves that does not live in the vicinity any more. This assemblage of *Tucetona laticostata*, *Ruditapes largillierti*, *Dosina zelandica* and *Oxyperas elongata* is inferred to have lived in a strong current-swept subtidal channel together with *Maoricolpus roseus* in a coarse sediment bottom, when the entrance to Tamaki Estuary was more exposed (prior to eruption of Rangitoto). Specimens of two subtidal bivalves (*R. largillierti*, *T. laticostata*) occur in life position in the beach rock at present mid tide level and indicate that sea level was at least 1.3 m higher than now at that time.

Introduction

A 1 m thick deposit of cemented pebble conglomerate, pebbly sand and shelly pebbly sand outcrops around mid-tide level at the north end of Bucklands Beach, on the east side of the entrance to the Tamaki Estuary, Auckland (Figs 1, 2). The bedding is horizontal to gently dipping seaward. The pebbles are up to 15 cm across and are predominantly made of basalt, presumably derived by erosion from Motukorea Island, 2 km to the north. Today there is no evidence of basalt pebbles being transported southwards into the Tamaki Estuary as they clearly were at the time these layers of sediment were deposited. Some of the layers contain abundant molluscan shells, some species of which no longer live in the vicinity.

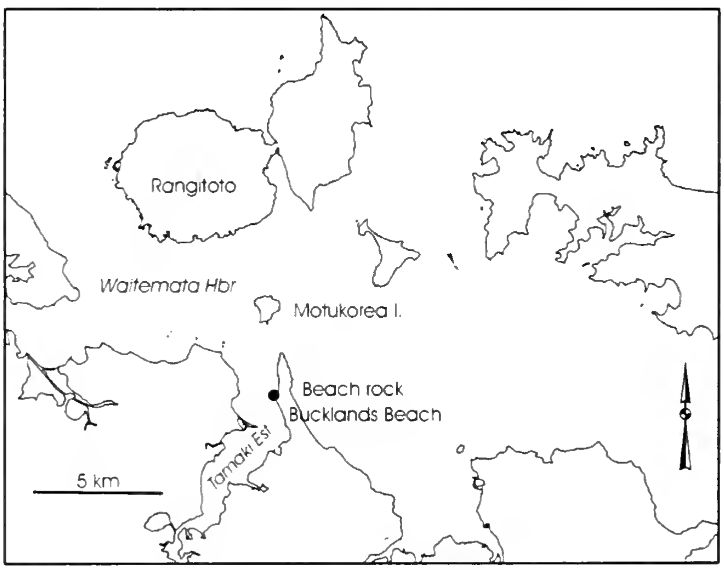

Fig. 1. Location of Bucklands Beach, Tamaki Estuary entrance, Waitemata Harbour.

Age

A small, vertically-oriented, in-situ *Tucetona laticostata* (Wk33780) was dated at Waikato University Radiocarbon Laboratory at 4965-5290 cal yr BP (95% probability).

Fig. 2. Beach rock exposed near mid tide level, north end of Bucklands Beach.

Mollusc Species List

An assessment of abundance of fossil shells is shown in lower case.
Their modern abundance is given in upper case, with live records from Bucklands Beach shown in italics. Modern data from Morley (2002) and Hayward and Morley (2008).
c = common
f = frequent
o = occasional
r = rare
- = absent

Gastropoda
Alcithoe arabica o *R*
Amphibola crenata r R
Coelotrochus tiaratus r R
Cominella adspersa r *F*
Cominella maculosa r *O*
Cominella virgata r *F*
Diloma aethiops r *C*
Lunella smaragdus r *C*
Maoricolpus roseus f *F*
Penion sulcatus o *R*

Missing in beach rock
Amalda australis - F
Cominella glandiformis - F
Diloma subrostrata - F
Haustrum scobina - F
Zeacumantus lutulentus - F
Zeacumantus subcarinatus – C

Bivalvia
Atrina zelandica r *O*
Austrovenus stutchburyi c *F*
Cleidothaerus albidus r *R*
Corbula zelandica r R
Dosina zelandica o *O*
Macomona liliana r *O*
Oxyperas elongata f -
Panopea zelandica r -
Paphies australis c *O*
Pecten novaezelandiae f R
Perna canaliculus f *F*
Ruditapes largillierti c two in-situ R
Saccostrea glomerata cucullata o -
Tucetona laticostata c one in-situ -
Venericardia purpurata r R

Discussion

Various layers within the beach rock have different shell compositions. Some are dominated by *Paphies australis* and *Austrovenus stutchburyi* similar to the modern Bucklands Beach nearby. Many parts of the pebbly coarse sand beach rock are dominated by the thick shells of *Tucetona laticostata* and *Ruditapes largillierti* accompanied by *Dosina zelandica, Oxyperas elongata* and *Maoricolpus roseus* (Fig. 3).

Fig. 3. Fossil 5000 yr old shells in beach rock, Bucklands Beach. Identifiable in the photo are *Tucetona laticostata*, *Oxyperas elongata*, *Maoricolpus roseus*, *Ruditapes largillierti*, and *Perna canaliculus*.

This assemblage is typical of that which lives in coarse substrates in strong current-swept subtidal channels (e.g. Hayward et al., 1981) with the closest known occurrence to Bucklands Beach being Rangitoto Channel (Powell, 1937). Clearly the beach rock assemblage lived in the Tamaki Estuary tidal channel at the time of accumulation and the environment must have been more exposed than today with a coarser substrate floor in the channel.

Rangitoto Island erupted in the middle of the Waitemata Harbour about 600 years ago (Lindsay et al., 2011) and prior to that, when the beach rock accumulated, the entrance to Tamaki Estuary would have been more exposed to the north. Browns Island would also have been much more exposed and the soft tuff rock on the north side eroded rapidly supplying basalt pebbles and coarse sand into the Tamaki entrance channel, which it does not do today.

Two conjoint specimens of *R. largillierti* and one juvenile conjoint *T. laticostata* were found in growth position within the beach rock coarse sand. We have seen rare living specimens of the former at spring low tide level but have never seen living specimens of the latter exposed intertidally. Both occur in the beach rock at present mid tide level and this implies that sea level was a minimum of 1.3 m higher 5000 yrs ago. Most of the other shells in the beach rock are rare and still living in the vicinity today. Many live infaunally in or epifaunally on the soft intertidal muddy sand whereas others live on rocky substrates or graze on seaweed. Rare shells not known to be living in the vicinity today are a number of native rock oysters (*Saccostrea glomerata cucullata*) and geoduck (*Panopea zelandica*). This latter species lives subtidally in relatively exposed sand substrates and the lack of washed up specimens today suggests that it is not living in the Waitemata Harbour, but possibly did in small numbers prior to the eruption of Rangitoto.

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THE SMALL, ENIGMATIC CEPHALOPOD *SPIRULA SPIRULA* (LINNAEUS, 1758) (DECABRACHIA, SUBORDER SPIRULINA) FROM THE TASMAN SEA

Michael K. Eagle

Abstract. An informal appraisal of the small cephalopod *Spirula spirula* (Linnaeus, 1758) as beach-drift flotsam emanating from the Tasman Sea upon Muriwai and Rangitira Beaches, North Island, New Zealand and possible ancestral precursors in the fossil record is made within the taxonomic classification of the Spirulidae. A systematic biological description including ontogenetic development and DNA nucleotide expressions, are given. Ecological aspects and environmental considerations of *S. spirula* made by historical field and laboratory observations and a note of the O13 and O18 isotope analysis of the internal planispiral buoyancy shell are discussed.

Keywords. *Spirula spirula*; Spirulidae; Spirulina; Decabrachia; Sepioidea; cephalopoda; mollusca.

Introduction

Along the forty-six kilometres of black titanomagnetite sands of Muriwai and Rangitira beaches, Auckland, west coast, vast numbers of white, fragile, decoiled shells, rarely with parts of the animal attached and some with *Lepas* spp. (Cirripedia: Thoracica: Lepadiformes (goose barnacles)) attached to the aperture and shell umbilicus can be seen washed up on the high tide line (Fig. 1).

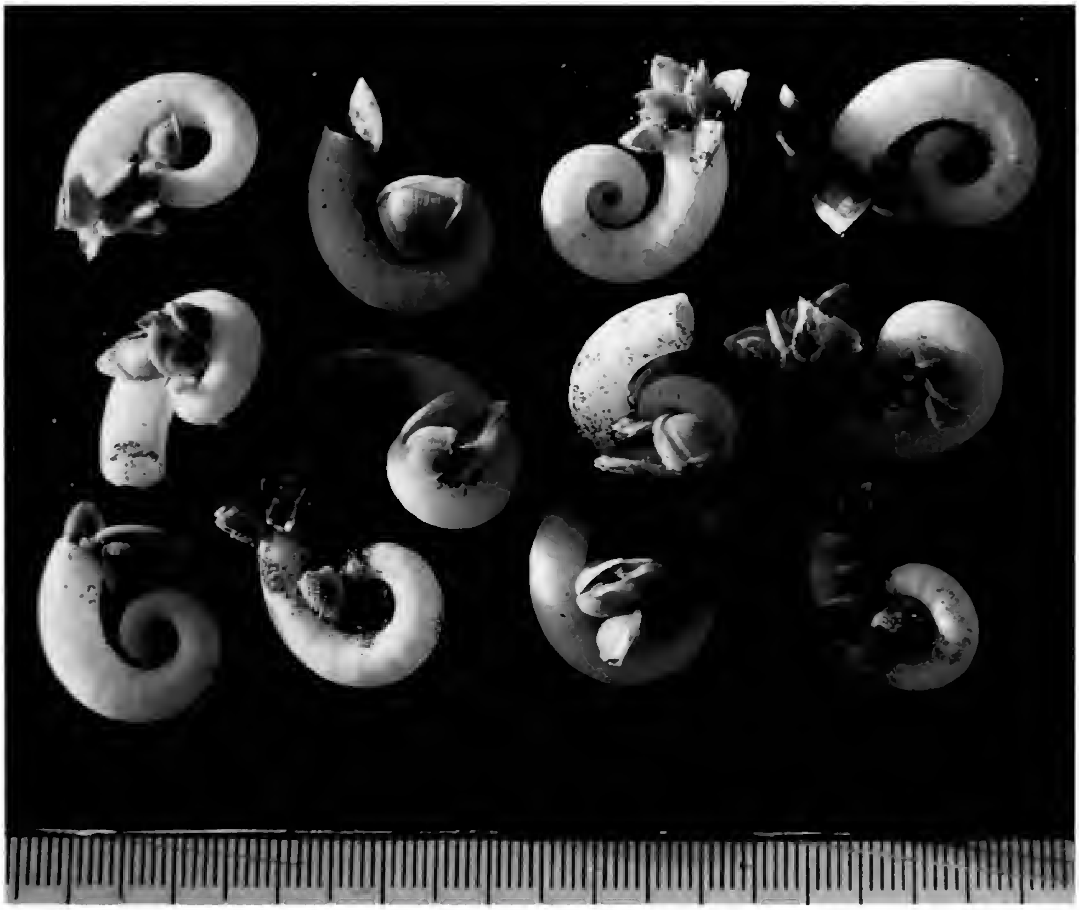

Fig. 1. Muriwai beach-drift goose barnacles (*Lepas* sp.) growing on internal buoyancy shells of *Spirula spirula* that have been floating in the Tasman Sea.

They belong to a globally distributed monotypic cephalopod known as *Spirula spirula* (Linnaeus, 1758). Cephalopods are marine molluscan invertebrates classified in the Order Decabrachia; the term cephalopod dates from 1823, being derived from the Greek: *kephalè*, head; and *pous* (the root is *pod-*), meaning foot.

The first complete *Spirula* to be described was one found at Port Nicholson in New Zealand (Gray, 1845). Because of its rarity in the early 19th Century this specimen was considered too valuable to dissect. *Spirula* regionally occurs in marine tropical to warm-temperate mesopelagic waters above the continental slope, regionally between 100 and 1750 m off the Coral Sea, about the Kermadec Islands, Tonga, the Pacific Ocean and Tasman Sea to the east and west respectively of the northern half of the North Island of New Zealand (see: Suter 1913; Dell 1952: 76-78; Powell 1979: 439). *Spirula* is distributed globally in sub-tropic to tropic oceans from about 30°N to 30°S (Clarke 1986) only occasionally inhabiting open oceans, preferring instead continental slopes and the slopes of islands along the margins of major seas (see: Joubin 1995). *Spirula's* range is disjunct and associated with closed circulations of intermediate water masses. For example, in the South Atlantic *Spirula* is found only off Namibia and Western Cape, probably expatriated from the south-west Indian Ocean, where a known population exists (Fig. 2). The small squid was originally described by Linnaeus (1758) as '*Nautilus spirula*', then observing only the nacreous shell morphology available.

Early scientific work on living *S. spirula* and post-mortem specimens obtained from commercial fishery by-catch were investigated in the nineteenth century by Gray (1845), Appellöf (1893) and Pelseneer (1895), and in the first half of the twentieth century by Chun (1910, 1915), Schmidt (1922), Naef (1922, 1923, 1928), Böggild 1930, Kerr (1931), Turek (1933) and Bruun (1943). Those detailed anatomical and morphological studies have been more recently complemented by Denton (1962), Clarke (1966), Young (1977), Bandel (1982), Nesis (1984, 1985), Dauphin (1976; 2001a, b), Joubin (1995), Young and Vecchione (1998), Lu (1998), Keupp (2000), Young and Sweeny (2002) Warnke and Keupp (2005), Lukeneder *et al* (2008), and Neige and Warnke (2010) and others.

Fig. 2. Distribution of *S. spirula*. *Light-grey* areas indicate live catches, *Dark-grey* regions mark shells found on beaches by drifting, and fishery by-catch. *Numbers 1–6* correspond to sites in the Luckeneder *et al*. 2008 study where shells were collected. Distribution map compiled after Bruun (1943), Goud (1985), Schmidt (1922), Norman (2007) (modified from Luckeneder *et al*. 2008).

Fig. 3. Lateral view photograph of *S. spirula* in life orientation (scale: x 2).

Systematic Classification

Kingdom:	Animalia Eukaryota Metazoa
Phylum:	Mollusca
Class:	Cephalopoda
Subclass:	Coleoidea Neocoleoidea
Superorder	Decapodiformes Decabranchia Sepioidea
Order:	Spirulida
Superfamily:	Spirulina
Family:	Spirulidae
Genus:	Spirula [synonymised. with Lituus Gray, 1847].
Species:	*Spirula spirula* (Linnaeus, 1758)
Type Species:	*Nautilus spirula* Linnaeus, 1758 (basionym) [synonyms: *Spirula fragilis* Lamark, 1801; *Spirula australis* Lamarck, 1816; *Spirula peroni* Lamarck, 1822]

Beachcombers and collectors know the remaindered chambered buoyancy shells by various common names such as "ram's-horn-squid" (Clarke 1966; Donovan 1977; Warnke *et al.* 2003; Lindgren *et al.* 2004)." also colloquially as "Neptune's finger-nails" in the United States of America, and "little post horns" in Europe – for their resemblance to the horns sounded on old-fashioned horse coaches.

Biology

Spirula spirula (Figs. 3, 5, 6, 10) is one of the smallest of the cephalopods, with adults usually about 5-7 cm long, half of this length being the tentacles. With the exception of the *Nautilus* (see: Auclair. Lecuyer, Bucher, and Sheppard (2004)), it is also the only cephalopod alive which has a calcareous decoiled spiral tubular shell divided into chambers. These are separated by curve-walled septa connected by a siphuncle running internally the length of the umbilicus, sealed to all chambers except the final one (Fig. 5a, b), biologically functioning as an internal 'float', sited in a sagittal plane within the posterior body cavity under thin skin.

The chambered shell of *S. spirula* located within the posterior of the animal, ranges in diameter from 18 to 23 mm. Chambers are structured from 3 (in the smallest known juvenile) to 40 (in

adults) and are filled with gas (97% nitrogen, 3% oxygen and carbon dioxide) and a little condensate that buoys the animal within the water column. Buoyancy is regulated by the internal calcitic shell apparatus, as in fossil ammonites, nautaloids, and modern *Nautilus* spp. The phragmocone of *S. spirula*, connected through a tiny ventral siphuncle, acts as a buoyancy regulating mechanism able to withstand a pressure of at least 200 atmospheres (Clarke 1986). Deterioration of the carcass post-mortem releases the buoyancy shell still sealed with gas, so that it floats to the surface.

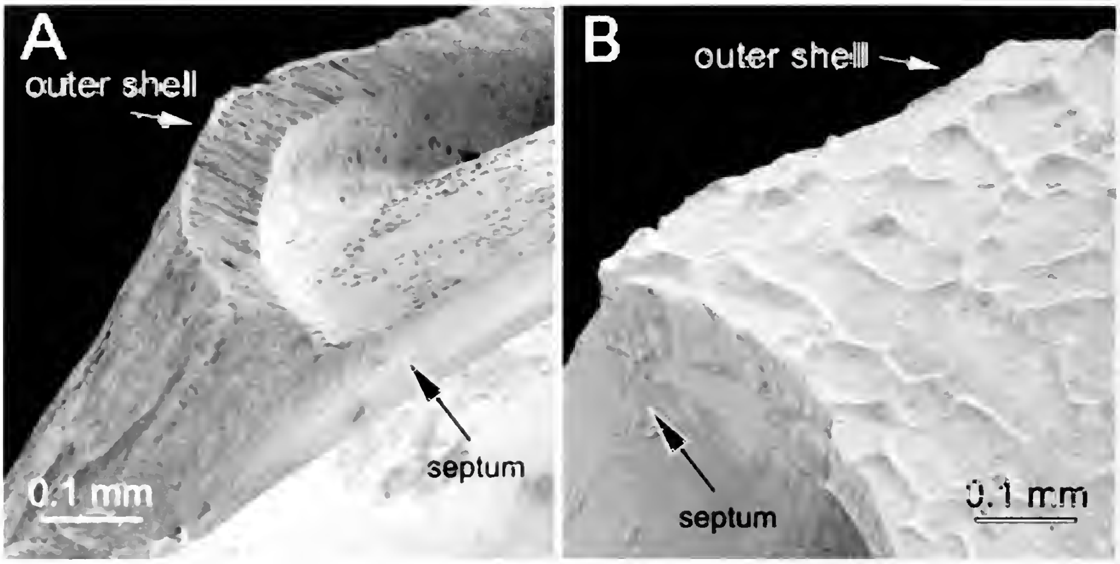

Fig. 4. A and B. SEM images of *S. spirula* aragonitic shell ultrastructure. In *Spirula* the connecting ring is composed of two layers: an outer spherulitic-prismatic layer and an inner glycoprotein layer, of which the latter is not preserved in dry shells and is structurally similar to that in Recent Nautilus and fossil nautilitid and tarphyceratid nautiloids. (after Lukeneder *et al* 2008).

Buoyancy shells of *S. spirula* are of pure aragonite and the wall is composed of three layers: the outer prismatic, the middle granular and the innermost prismatic (Appellöf 1893; Dauphin 1976; Dauphin 2001a, b; Doguzhaeva 1996, 2000; Mutvei 1964; Mutvei and Donovan 2006). Chamber septa are constructed of four different aragonitic layers (Fig. 4), these being the dorsal conchiolin, then the spherulitic-prismatic, a nacreous, and the semi-prismatic layers. Hexagonal aragonite platelets typical for the nacre layer existing in other cephalopods are absent. Buoyancy shells of *S. spirula* are completely enclosed by the mantle which is subcutaneous and located in a completely closed sac adhering to the outer wall of the shell (Chun 1915). The shell is open planispirally coiled and is formed internally within the posterior of the body where it is covered by soft tissue during most of the squid's life; only in fully grown adult specimens does the internal shell foraminate the mantle on the ventral and dorsal sides. Due to its calcareous composition, the buoyancy shell is suitable for stable isotopic analysis using _18O and _13C measured successively in chambers of the aragonitic shell and this data has been used as a biological proxy to interpret ontogenetically related environmental changes in the cephalopod (Lukeneder *et al.* 2008).

The mantle of *S. spirula* is thick, but not fused with the head, cylindrical, thin and muscular externally with a pair of small round fins attached transversely to posterior end of mantle. Maximum mantle length is 45 mm, rarely larger. Anterior margin of mantle with 3 pronounced projections on midline and ventrolaterally on each side of the simple, straight, funnel-mantle locking cartilages. The animal's eyes are large, protruding, and are covered by transparent skin as muscular eyelids. Mobility fins are small, kidney-shaped, near the very end of the body and oblique to the longitudinal body axis (Fig. 6A). A large round photophore is located between the fins at the end of the body (Fig. 6B). The bases of all 6 arms are joined by membrane. Arms have 2 rows of suckers. Tentacles are retractable each with a thin stem and small widened club distally.

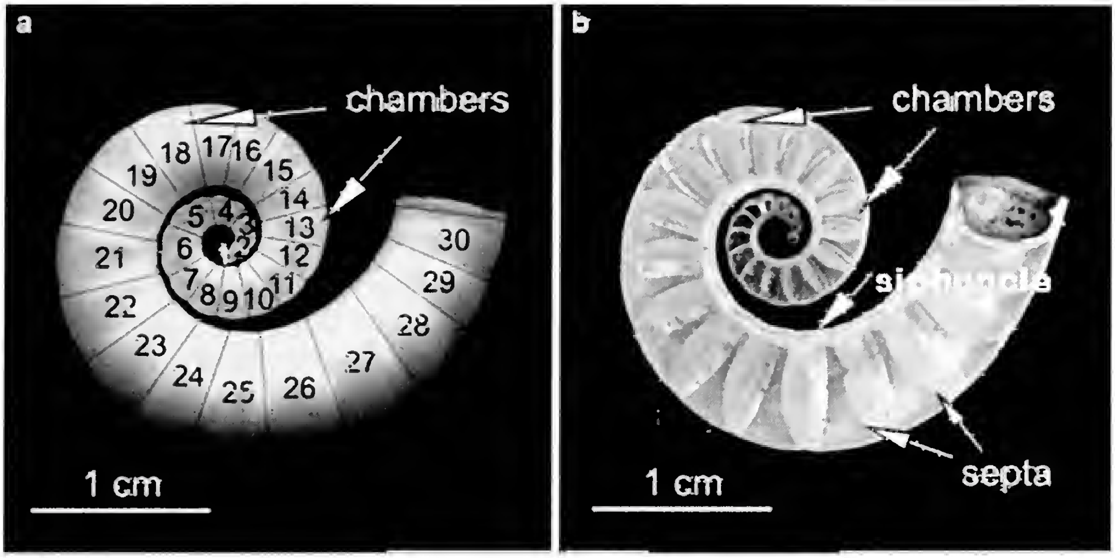

Fig. 5. *S. spirula* internal buoyancy shell: a. side view with chambers numbered 1–30 in growth direction; b. Median section of shell showing chambers separated by septa with internal siphuncle following the umbilical line (modified from Lukeneder *et al* 2008).

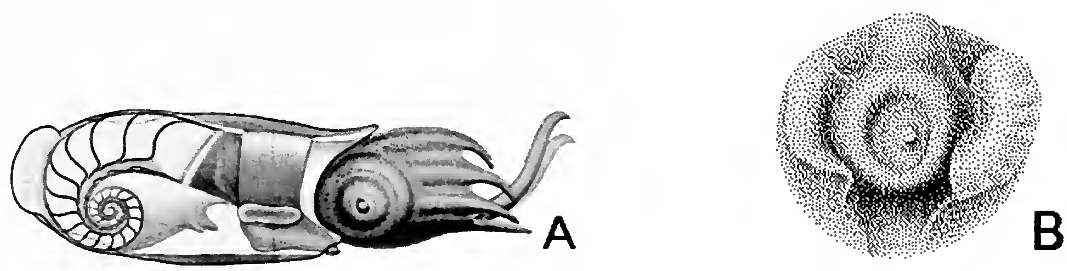

Fig. 6. A. Diagrammatic lateral internal view of *S. spirula* showing life position of the buoyancy shell.
B. Diagram of the photophore located between the posterior fins (no scale implied).

The length of *Spirula* arms increases from ventral to dorsal arms; each arm with 4 to 6 rows of small suckers; a non-expanded club exists on each long tentacle with 16 rows of numerous small suckers (Fig. 7). All arms (except between ventral arms) are connected with a web. Both ventral arms of males are hectocotylized (modified arms in males used for transferring spermatophores to the female), the left arm tip modified into a complex organ of unknown function.

Needham's sac resides in male *Spirula*. It is an expanded region of the genital duct at the base of the penis utilized as a large storage repository for spermatophores. A spermatophore is a packet of sperm that is formed by the male and passed to the female during mating. In *Spirula*, this packet is very complex, containing a sperm mass, an ejaculatory apparatus and a cement body. Except for the sperm, the entire structure is non-cellular and consists of a complex architecture of secreted material. The mollusc's natural colour is creamy-white with maroon-red markings. Egg size is between 1.5-1.7 mm diameter; the maximum length of the smallest juvenile is 1.5 mm; the maximum length of adults is up to 7.7 cm.

Fig. 7. Photographic image of one of two small, widened distal clubs belonging to *S. spirula* showing arrangement of club suckers (from Chun 1910; no scale implied).

Cephalotoxin is contained in the venom of *S. spirula* (as it is in other cephalopods) and is excreted by the salivary glands; it has a paralyzing effect on prey or predator. *Spirula* have complex multicellular organs named chromatophores (Fig. 8) which they use to change colour rapidly (enabling homochromism); they constitute a unique motor system that operates upon the environment without applying force to it.

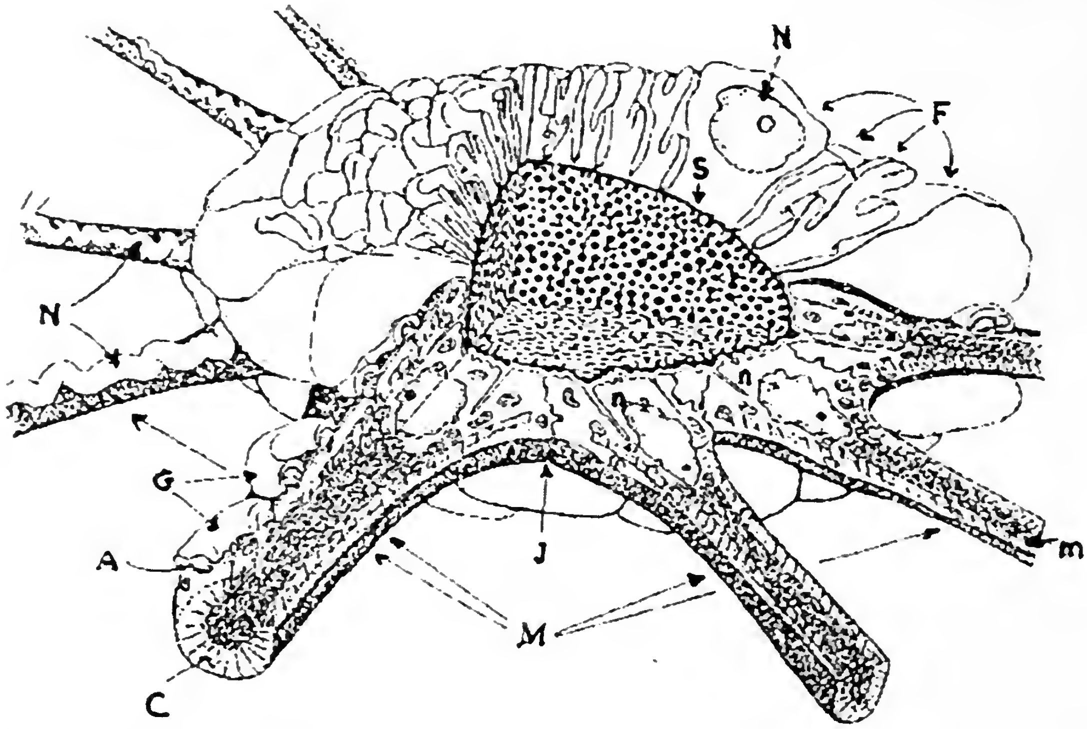

Fig. 8. Diagram of the ultrastructure of a retracted chromatophore organ: A. axon; C contractile cortex of muscle fibre; F. folds of cell membrane of chromatophore; G. glial cell; N. nerve terminals; n. nucleus of muscle cell; M. muscle fibres; m. mitochondria. J. junction between adjacent muscle fibres; S. elastic sacculus; (note: that the sheath cells that enclose the chromatophore and the muscle fibres are not shown; modified from Cloney and Florey 1968).

The chromatophores of *Spirula* differ fundamentally from those of other animals, being neuromuscular organs rather than cells and not controlled hormonally. Each chromatophore unit is composed of a single chromatophore cell and numerous muscle, nerve, glial and sheath cells. Inside the chromatophore cell, pigment granules are enclosed in an elastic sac, called the cytoelastic sacculus. To change colour the animal distorts the sacculus form or size by muscular contraction, changing its translucency, reflectivity or opacity. *Spirula* can operate chromatophores in complex, chromatic displays, resulting in a variety of rapidly changing colour schemes. The nerves that operate the chromatophores are thought to be positioned in the brain in a pattern similar to that of the chromatophores they each control. This means the pattern of colour change matches the pattern of neuronal activation. *Spirula* are also thought to use physiological colour change for social interaction. They are also skilled at background adaptation, having the ability to match both the colour and the texture of their environment.

Spirula possesses two sensory statocysts (sense-organs that detect gravity, angular accelerations and low-frequency sound). Statocysts are embedded within the cephalic cartilage and contain statoliths located ventrolaterally on either side of a primitive 'brain'. They are ovoid organs with a single undivided cavity and are embedded in fibrous tissue where the three main cords of the nervous system meet. *Spirula* statocysts are formed from ectodermal invaginations and remnants of these invaginations persist as a Kölliker canal. The Kölliker canal proceeds laterally from the statocyst towards the surface by a small pore at the base of the olfactory tentacle, or rhinophore, below the eye. The inner surface of the canal is ciliated and remains open in the adult (Young 1965). The

crista/cupula system of *Spirula* acts as a gravity receptor organ and can detect rotary movement (angular acceleration).

Spirula spirula DNA nucleotide studies have centred on the: rhodopsin gene, pax gene, 12S ribosomal RNA gene; isolate SP-01 16S ribosomal gene; octopine dehydrogenase gene; strain FU-dd1 hemocyanin gene; strain FU-fg hemocyanin gene; cytochrome c oxidase subunit (COI) gene; 28S ribosomal DNA gene; 18S ribosomal DNA gene; histone H3 gene; 16S ribosomal RNA gene; clone 40 actin gene; clone 22 actin gene; mitochondrial partial coiii gene; mitochondrial 16S rRNA gene; 12S ribosomal rRNA gene; mitochondrial partial 12S rRNA gene; partial 18S rRNA gene; partial 28S rRNA gene; mitochondrial coxIII gene; and mitochondria lrRNA gene. Data obtained from *Spirula* DNA confirms allocation to the Sepioidea. Some *Spirula* protein, popset and GEO profile studies have also been undertaken.

DNA: Rhodopsin Gene, Partial CDs

mRNA <1..>864
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KAQAGASAEMKLAKISIIIICQFLLSWSPYAIXALLGQFGPIEWITPYLTMIPVMFAK
ASAIHNPLIYSVSHPKFREAIQENFPFLLTCCRFDDKEVEDDKDAEVELPPEPEGGGE
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GAPPQTAPPQGV"

ORIGIN
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  1 agaatgaacc atagaagggc tttccttatg ctcatcttcg tctgggtgtg gtcaaccgtg
 61 tggtctatcg gccccatttt cggctggggc gcttacgtat tagagggaat actctgcagt
121 tgctcttttg attatattag tagagattat tcaacacgat ccaacattgt ctgcatgtat
181 ctcctcgctt tttgtgtccc cattcttatc attttcttct gctacttcaa cattgtcatg
241 tccgtgtcca accacgagaa agagatggca gctatggcca agagattgaa tgccaaggaa
301 ttgcgaaagg ctcaggccgg agctagcgct gaaatgaaac tggccaagat ttcaattatc
361 atcatctgtc agttcttgct ctcctggagt ccctatgcna tcntggcact tcttggccag
421 ttcggtccaa ttgagtggat aacaccttat ctcaccatga tccctgtcat gttcgccaag
481 gcttctgcta tccacaaccc actaatctac tctgtatctc accctaagtt ccgtgaggct
541 atccaagaga atttcccatt tttactcaca tgttgtcgat tcgatgacaa ggaagttgaa
601 gatgacaaag acgcagaagt tgaacttccc cctgagccgg agggtggcgg cgagggcggc
661 gctgatgctg cccagatgaa ggaaatgatg gctatgatgc agaagatgca acaacagcag
721 gccgcttatc caccacaagg agcataccca ccacagggtt acccgccacc acaagcagga
781 tacccaccac agggatatcc accaccacaa ggatacccac caccccaagg agcacctcca
841 caaacagccc cacctcaggg ggtt
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12S ribosomal RNA gene, partial sequence; mitochondrial:
rRNA complement (<1..>399)

ORIGIN
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 61 gtccaacctc ataaattagt tacataattt aatcagataa aaaattataa atcgtagctc
121 actttcaata tcttttctat tagctgcatt ttgacttgac attataacct cacattatta
181 agttttttcc aaaattttta caaaataaac tgacgacagc aatatacaaa ctgatattat
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301 gatatataac accgccaagc cttttaaatt tcaaacataa acgtacttta cattatttac
361 attcatacta cttaagtaac aaatttttaa aataaagaa
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NOTE: Neige and Warnke (2010) used morphometry to provide a criterion for determining termination of shell growth (i.e.: decrease in whorl height) in comparing 110 *S. spirula* shells from five geographical areas. In that study they found that characteristics of adult shells of *S. spirula* varied with geographical origin and that specimens from Madagascar, New Zealand and Brazil are larger than those from North-West Africa and Australia. Neige and Warnke (2010) suggested that (:1) “these findings challenge the monospecific status of the genus *Spirula* but fall short of proving the occurrence of more than one species.”

Ecology and Environment

The body of *Spirula* is cylindrical and whitish, with rust-red or brown stippled markings. When threatened or disturbed it retracts arms, tentacles and head under the toughened mantle into the mantle cavity, sealing shut the open end for protection. It is one of the few deep-sea animals that can withstand water temperature, salinity, and pressure differentials when captured and brought to the surface. Consequently it has been kept alive for long periods of time in shipboard aquaria (Idyll 1976). Scientists on the Danish research ship Dana (1920-1922) were amongst the first to live-capture *Spirula*. They recorded its swift, jerky movements as it swam by squirting water from its little siphon. Until the "Dana" expeditions only 13 specimens had been captured. Almost nothing was known of the biology and distribution of *Spirula* until the preliminary note by the leader of those expeditions, Johs Schmidt was published in 1922. The note contained observations of live specimens as well as a short outline of results derived from the 95 specimens caught.

Spirula normally lives in a vertical position with the hectocolylizcd arms, eyes and head pointed toward the ocean bottom, so that it floats or swims with the head and tentacles dangling downwards (Fig.3). The coleoidid achieves this by regulating internal buoyancy whilst fluttering two fins at the body posterior (the uppermost end), to aid swimming. The work of Bruun (1943) and that of Denton (1962) helped elucidate upon the hydrostatic mechanism of *Spirula*. Biologists of the Danish Galathea Deep Sea Expedition (1950-1952) caught some of the earliest live-taken specimens of *Spirula* in both the Indian and Atlantic Oceans, observing and documenting their morphology and behaviour.

Spirula makes considerable daily vertical bathymetric migrations and is stenohaline. The distended, malleable properties of *Spirula*'s visceral mass is able to withstand the great changes of pressure encountered during such rising and sinking, as can the buoyancy shell which has chambers filled with gas of commensurate pressure. Apparently the gas can only be regulated in the final shell chamber since all others are sealed. It is uncertain whether gas is able to pass through the pores of the shell to also facilitate gas regulation. Between its two posterior fins *Spirula* has a small ducat photophore pointing toward the ocean's surface that is capable of being "shuttered" by the animal by means of a mobile diaphragm. Unlike the luminescent organs of many other deep-sea creatures which flicker on and off, *Spirula* is able to (if required), use the photophore to shine steadily with a pale, yellowish-green light (Cousteau and Diolé 1973; Idyll 1976).

S. spirula occurs mainly over continental and insular slopes and in the open ocean not far from such slopes. Lukeneder et al. (2008) measured stable isotopes (18O and 13C) in successive chambers of Tasman Sea *S. spirula* aragonitic shells collected from Ulladallah, south-east Sydney coast (Figs. 2, 5). The stable isotopes of Tasman Sea *S. spirula* shells indicate that these squid spawn on the sea floor at a depth of >1000m, hatching in the benthos. Evidence suggests that larvae do not migrate. Development is almost direct. Embryonic stages, and their bathymetric realm are reflected in the 13C carbon signatures obtained; the data demonstrates *S. spirula*'s life cycle in bathyal depths after hatching. Migratory behaviour is initiated after forming the first chambers (Lu 1998), when juvenile squid then move into warmer, shallower waters at outer-shelf (400–600 m) depths. *Spirula* is documented by fisheries data as having a diurnal migration into inner shelf waters (c. 200m) (Clarke 1970), not reflected in the isotope data of Lukeneder et al. (2008), probably because *Spirula* reduce biomineralisation during that developmental phase. *Spirula*'s isotope signatures peak during midlife, perhaps due to sexual maturation, prior to migrating as they grow older into a shallower, warmer habitat, confirmed by fishery catch data.

Isotopic 13C values indicated four ontogenic phases: embryonic, juvenile, adolescent, and adult. Isotopic 18O data specifies a minimum environmental temperature of 4.3°C in *S. spirula*'s embryonic stage, 13.4°C in adolescent specimens, and 9.1°C in their last months of life, when, at

the age of approximately 1.5 year (Clarke 1970) *S. spirula* migrates into deeper, cooler water where they spawn. Isotope 18O data supports this showing a stable phase during *S. spirula*'s first month of life (Fig. 8). Embryos probably stay in cooler waters for the first phase of life. Upward migrations apparently start at around chamber 5 (see: Fig. 5). The isotope 18 O curve illustrates that the lowest depth (a water column temperature of 13.4°C) is reached coincident with sexual maturity, also reflected in the isotope 13C signature. The same ontogenetic differences were observed by Clarke (1970) when reporting three different size-groups in 256 *S. spirula* specimens caught by fishery vessels with different types of nets around Fuerteventura Island (Canary Islands, Northern Hemisphere). The largest individuals were 2.4–4.6 cm in maximum mantle length, with mature females being smaller.

The isotope18O data suggest that after hatching at depths >1,000 m at temperatures of 4–6°C, the squid migrate into shallower, warmer waters at 12–14°C at depths of 400–600 m. Subsequently, the increasing isotope18O values suggest a migration back into somewhat cooler, deeper habitats. The isotope13C values also revealed three ontogenetic stages in specimens, including a major shift from positive to negative values, which probably corresponds to sexual maturation, the initiation of reproduction, and concomitant changes in diet. The data, combined with the scanty life history information from previous studies of *S. spirula*, can be used to compare the habitat requirements of related extant and fossil cephalopod genera.

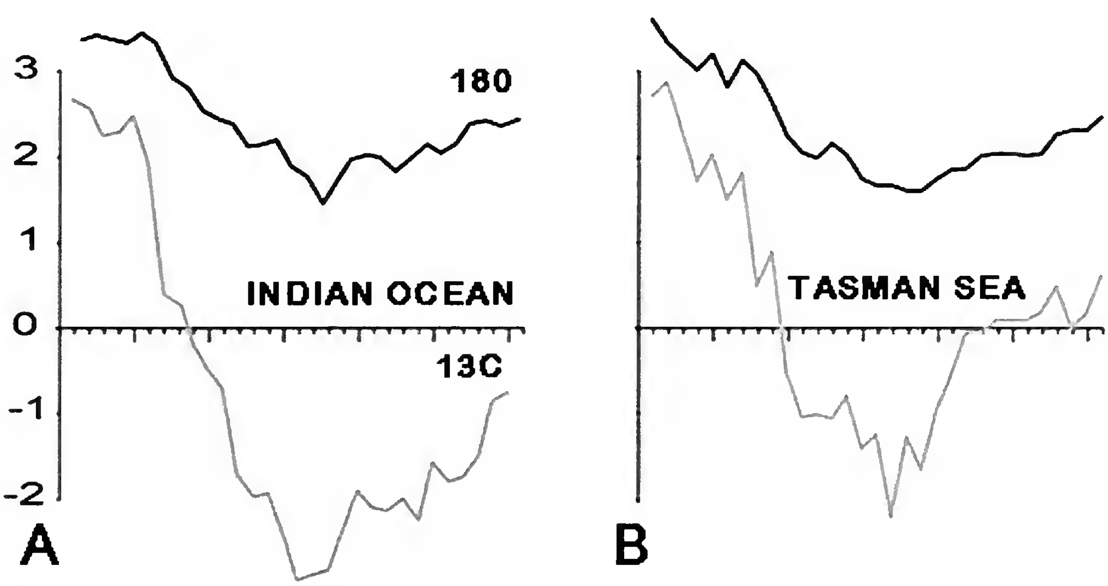

Fig. 9. 18O isotope data for six shells each of *S. spirula* from the Southern Hemisphere: A. Indian Ocean; B. Tasman Sea (after Lukeneder et al 2008).

In summary, the small squid spawns on the bottom at bathyal depths. Early juveniles ascend to mid-shelf depths, and late juveniles, adolescents, immature sub-adults, and adults migrate from approx. 100-300 m at night to 500-1000 m at day.

Spirula spirula apparently spawns in deep water benthic habitats over the deepest slopes (1,000–2,000 m), with optimal location about tropical islands (Bruun 1943; Clarke 1970; Goud 1985; Young et al. 1998). Females are thought to lay strings of white eggs attached together stuck to benthic debris on the bottom of the lower continental slope at depths down to 1,750 m. This breeding strategy is comparable to many other middle-shelf to abyssal open-water nektonic cephalopods, although most benthic inhabitants prefer shallower depths, inner- to middle-shelf.

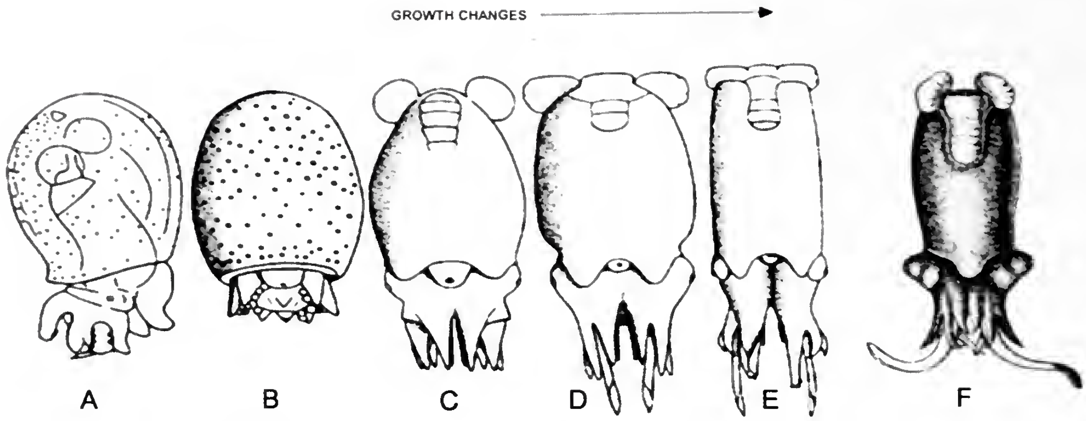

Fig. 10. Growth stages in *S. spirula*: A. larvae – F. mature adult (A-E modified from Nesis 1984, F is rendered after various sources).

As is characteristic of many nektonic ocean dwellers, *S. spirula* undertakes vertical diurnal migrations (Clarke 1969) into shallower waters to feed on other molluscs, plankton, and small pelagic crustaceans such as krill, copepods, and ostracods, confirmed by specimen stomach dissections (Nixon and Dilly 1977). Prey selection also appears to be an attribute of the small cephalopod (Kerr 1931; Young 1977). Squid are known to be cannibals and this may also be true for *S. spirula* (Cousteau and Diolé 1973).

Summary

Depth distribution of *S. spirula* changes with age. Juvenile (smallest) specimens of exist at depths of 1,000–1,750 m Bruun (1943), with the latter depth suggested by Clarke (1969) to be the oceanic thermocline unable to be crossed. Adult *S. spirula* occur in depths of 550–1,000 m during the day (concentrated at 600–700 m), with night animal aggregations recorded at 100 to 300 m (concentrated at 200–300 m) (Clarke 1969). The _18O data of covering adult *S. spirula* specimens sourced from the Atlantic and Indian Oceans, and the Tasman Sea suggests that after hatching at depths >1,000 m at temperatures of 4–6°C, *S. spirula* migrate into shallower, warmer waters at 12–14°C at depths of 400–600 m. Subsequent increasing _18O values then suggest a migration of the squid back into cooler, deeper habitats. Additionally _13C values revealed three apparent ontogenetic stages including a major shift from positive to negative values, probably corresponding to sexual maturation, reproduction initiation, and concomitant changes in diet. A fourth embryonic stage (not detected in the oxygen data) accompanied by markedly less positive _13C values in the first few chambers of the buoyancy shell, has been recorded in Atlantic and Indian Ocean specimens, but not those of the Tasman Sea (Lukeneder *et al* 2008).

Pristine buoyancy shells provide a reliable geochemical archive, reflecting ontogenetic, feeding, migration and life-span (see: Eichler and Ristedt (1966), Cochran *et al.* (1981), Taylor and Ward (1983), Rexfort and Mutterlose (2006), Landman *et al.* (1983, 1994), and Lukeneder *et al* (2008). Otherwise, interpretations of the ecology and habitat preferences of this cephalopod species are currently based on dredging.

Fossil Record

Cephalopods possess a surprisingly good fossil record, based not on the preservation of soft tissue morphology, but on the preservation of calcareous biological buoyancy structures. These robust ancestral 'shells' preserved by mineral replacement in ancient rocks derived from primeval ocean sediments indicate that most of the fantastic overspecialisation possessed by many of the prehistoric forms of cephalopod have disappeared. *Nautilus*, represented now by six species, is the sole survivor of thousands of species that swarmed the seas in Paleozoic and Mesozoic times between 65 and 542 million years ago.

Though derived from a primitive monoplacophoran mollusc similar to the bathyal species *Neopilina galathea*, the primitive cephalopod *S. spirula* radiated away from an external exoskeleton suited to a semi-sedentary benthic repose, to that of an external chambered shell more suited to a nektonic mode of life. As the mollusc outgrew each successive chamber grown, these were filled with biologically produced gas, enabling buoyancy in the water column and permitting the animal a better freedom of movement by reducing drag. An early example of this is Orthoceras de Blainville, 1825 a Paleozoic nautaloid well known from the Ordovician rocks of Morocco and elsewhere. A more sophisticated example is the New Zealand Early Jurassic (Hettangian) ammonite *Psiloceras* Hyatt, 1867 representing a much later development stage of the cephalopod group. At about this time two main evolutionary lines diverged with one branch producing the Nautiloida, including the modern tropical *Nautilus* with a coiled and many chambered external shell, and the other branch resulting in the squid-like more or less straight and many chambered internal shelled Belemnitida.

Belemnites were a successful group that evolved internal shells as a means of stream-lining flotation capability as well as utilising the weight of the gas-filled shell as ballast when swimming efficiently (e.g. hydrostatic qualities). Preserved in the fossil record belemnites resemble elongated stone bullets and were called “thunderbolts” by 16th Century “curiosity” seekers who thought that they were flung from the sky. New Zealand belemnites are common in the Jurassic and Cretaceous periods, with some stages more profuse in numbers than others. *Belemnopsis aucklandica* (Hochstetter, 1863) is a Late Jurassic belemnite stratigraphic marker fossil for the Puaroan Stage and *Dimitobelus lindsayi* (Hector, 1874), the same for the Late Cretaceous Piripauan Stage. Belemnites appear to have become extinct in the Eocene, Early Cenozoic.

Squid, cuttlefish, and octopuses are not direct phylogenetic descendants of the belemnites, but radiations of that ancient group of cephalopods. Their relationship to the belemnites is indicated by the: internal cuttlefish ‘bone’ of *Sepia officinalis*; the pen (a thin, horny internal skeleton) in the squids such as *Architheuthis princeps*; and a few calcareous grains in the octopuses such as *Octopus vulgaris* Lamarck, all recorded from New Zealand waters. It is generally acknowledged by cephalopod workers that *S. spirula* is a living descendent radiated from the belemnites. A specimen captured by scientists aboard the oceanic exploration voyage of H.M.S. Challenger during the ship’s exploration years 1873-1876 was entrusted to T. H. Huxley for description. Huxley was at the time on the lookout for modern belemnites perhaps thought to live in deep ocean refugia. However, Huxley did not consider *S. spirula* to be one or even related to the ancient precursor. *Spirula*’s most obvious link with the belemnites is a chambered internal shell, albeit coiled planispirally like a ram’s horn. It is the only known living cephalopod possessing this morphology.

The Spirulida, are derived from precursers having a spherical initial chamber that later underwent abbreviated ontogenesis, become reduced, and lost the spherical protoconcha. Evolution towards the Spirulida *sensu stricto* is exemplified in Cretaceous *Naefia* having a rudimentary spur-like proostracum flattened out and only a short basal ring-like part of the living chamber (the cingulum camerae terminalis), remaining. Early Cretaceous *Adygeya* from the European Caucasus, described by Doguzhaeva (1996), exhibits similar morphology, indicating that morphological change took place early Late Mesozoic. Fossil *Adygeya* possess only a slightly cyrtocone shell but already had a completely smooth edged terminal chamber like that of *Spirula* (Haas 2003).

The numerous fossil forms of the Spirulidae have been split into many genera so that only some morphologically important forms are represented here (Fig. 11; in more or less typological ranking). Notable in the Spirulida is the edge of the last chamber as an insertion site for the obsolete muscular mantle and insertion of retractor muscles. The muscular mantle is now located outside of the cingulum rim at a club- or bowl-shaped rostrum to which it is attached. This evolutionary trait provides visceral space, especially for the gonad, which emigrated from the last chamber (Fig. 3). Only the posterior part of the digestive gland remains within the former living chamber. An

endogastric coiling of the longicone shell is observed in the Spirulida, evidential by the slight curvature of the apical part of the phragmoconus of primitive ancestors like *Groenlandibelus, Naefia* and *Adygeya*. Progressive stages of the above-mentioned descensus viscerum are also demonstrated in reconstructions of Eocene *Beloptera* de Blainville 1827 (fossil cuttlefish from Germany), and Miocene *Spirulirostra* (from Italy; Fig. 11c). *Amerirostra* is another Spiruildae, but the theca has a higher degree of coiling than in *Spirulirostra* and there is an almost isolated dorsal plate originating from the epiconcha which is connected only by a narrow bridge with the epiconchal envelope of the theca (Jeletzky 1966, 1969). It must be assumed that the muscular mantle inserted at the edges of that dorsal plate. In most of the Tertiary forms a heavy rostrum possibly served as a counterbalance for the phragmoconus to keep the animal in a more or less horizontal position. Their robust morphology suggests highly manoeuvrable, short distance swimmers living near the sea floor. In *Spirula* the rostrum is given up and only a thin epiconcha covering the spiral remains. With reduction of the heavy rostrum, *Spirula* changed from a benthic to a bathypelagic life style. Some of its autapomorphies in this context are: loss of the radula, possession of a terminal light organ, and small circular apical fins positioned at the end of the body (Haas 2003).

The internal longicone, multi-chambered Spirulidae buoyancy shell follows the formula of an endogastrically coiled logarithmic spiral with loose whorls. Primitive representatives of the family show only curving of the apical part whereas growth of the proximal portion of the shell is tangential to that of the spiral. In later evolutionary steps the spiral portion increasingly took possession of the tangential part. Contrasting other Decabrachia, modern Spirulida have altered their structure by relinquishing the shells terminal chamber as a living repository, to accommodate part of the digestive gland. The Spirulida with a sphaeroidal initial chamber, are characterised by the following major synapomorphies: total reduction of the proostracum and endogastric incurvation or coiling of the narrow phragmoconus. The fast-moving nektonic carnivore fossil genera Belemnosis, Belemnosella, Spirulirostra d' Orbigny, 1842 and Amerirostra form the stem-lineage of Spirula. Groenlandibelus, Naefia and Adygeya (from the Lower Cretaceous of the Caucasus described by Doguzhaeva (1996)), are presently assigned to the stem-lineage of the Spirulida.

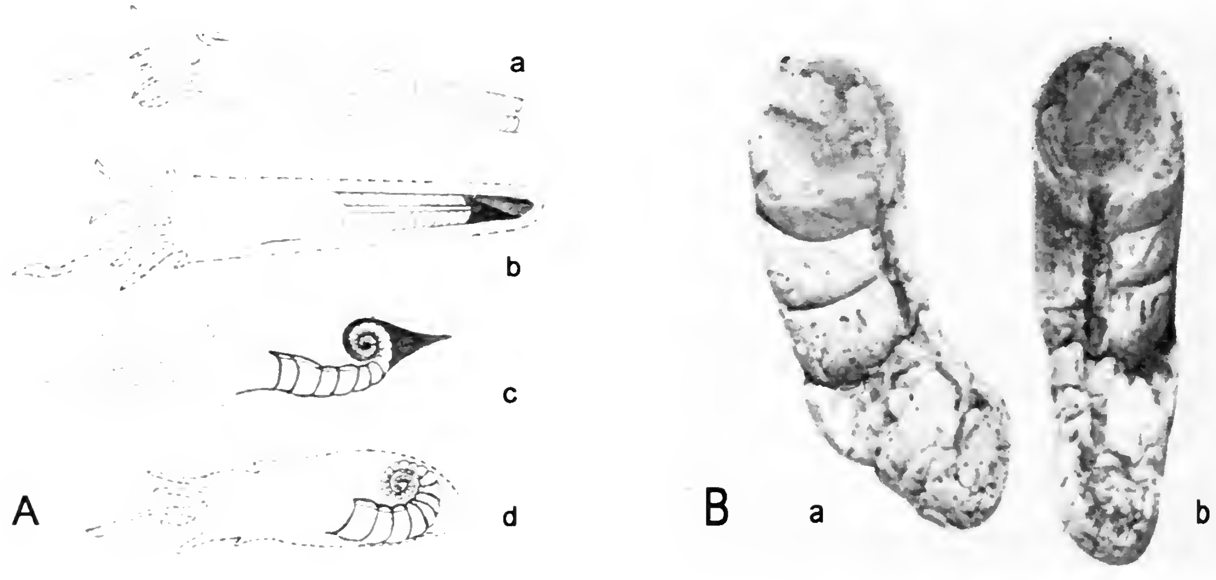

Fig. 11. A. Diagrams showing the likely evolution of modern *S. spirula* from an early gastropod-like ancestor. The animals are drawn in simplified section. a *Orthoceras*, a Palaeozoic nautaloid with many-chambered external shell; b. Mesozoic *Belemnopsis* belemnite with internal shell; c. Cenozoic cephalopod *Spirulirostra* with partially spiral internal chambered shell. d. Cenozoic and Recent *S. spirula* with internal spiral shell.

B. Photographs (a. oblique lateral, b. internal coil) of the internal cast of a six-chambered segment of a New Zealand Early Miocene *Spirula* internal chambered buoyancy shell (B. from Hayward 1976). No scale implied.

An inventory of New Zealand Cenozoic Mollusca compiled by paleontologist and conchologist P. Maxwell (2009: 232-254) lists the Aturiidae, Hercoglossidae, and Nautilidae of the subclass Nautaloidea and Argonautidae of the order Octopoda. No member of the subclass Dibranchia, family Spirulidae is recorded therein. However, Hayward (1976) described a (Lower Altonian (Burdigalian; Early Miocene)) six-chambered segment of a broken *Spirula* phragmocone (Auckland University Paleontolgical Collection Number AU2376)). The 12mm specimen segment was found at N28/f633, N28/728332, in a 1m thick, massive, fossiliferous, coarse volcarenite cliffs, 100m north of Paparoa Point, west Hukatere Peninsula, Kaipara Harbour, northern New Zealand. Hayward's discussion (:147) correctly states "There is no trace of a guard in this New Zealand fossil nor any sign of straightening of the phragmocone (a character of *Spirulirostrea*; (see: Fornasiero and Vicariottio 1997). Its remarkable morphological similarity to living *Spirula* leaves little doubt that Hayward correctly named the specimen and that this genus had evolved by the lower Miocene, possibly as a branch of the Spirulirostridae (Easton 1960: 476)." *Spirula*'s small size, gyroconic shape, septa chambered shell, aragonitic shell composition, susceptibility to fragmentation by crushing, and leaching probably precludes preservation and is the reason for global rarity in the fossil record. The much colder climate of the New Zealand Pliocene and Pleistocene periods may have also precluded colonization, reflected by a non-appearance in the New Zealand fossil record.

The unusual morphology of *Spirula* accommodates many paleontological papers as a modern genus attempting to interpret the prehistoric ecology of Mesozoic belemnites and ammonites; *S. spirula* affords an insight into the autecology of these prehistoric organisms, complements the evolutionary history, and offers a modern appreciation of ecological and environmental range of the group. It is possible that application of relevant isotopic methods to Mesozoic ammonites and belemnites as undertaken with Recent cephalopods, may reveal the strategies and environmental conditions of fossil faunas.

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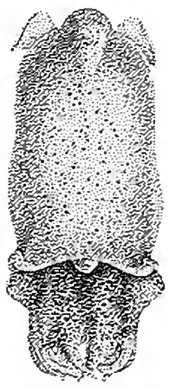


TE TOHEROA

W. B. Weber - Kumeu, West Auckland

When I was born in 1941, the Toheroa played major part in the family's diet, until it became illegal to interfere with them at all. We used them as bait, or ate them raw right there on the beach. They could be steamed open, minced with onions for fritters and tomato sauce added afterwards. On the beach they could be steamed open on the exhaust manifold of the old cars that were used to cart us to our favourite fishing spots, and would be ready for a fastfood snack upon arrival.

Toheroa soup was excellent, and was exported as a delicacy worldwide. The trouble is they are in decline, and no one seems to be able to grow them, but I imagine if we could, we could just about pull this country out of debt, if we had this knowledge. All of these things came to mind after my short stay at Muriwai Camp the other day.

I remember when we would always dig a few, in rough west coast weather to take with us up the beach to the Kaipara for bait, and eating in the shelter of the harbour. You could take 2 or 3 as reserve bait while fishing and plant them reverse end up in the sand so they could not escape. The Toheroa would try every trick to topple themselves so they could quickly bury themselves and escape. As the tide came in, they would release themselves from the sand and allow the tidal current to carry them away.

They didn't like this sandspit. Nor did they like certain areas of the main beach and would always behave in that manner where they did not like it. Many years later I discovered that it was the lack of inflow of ground water from inshore that caused their dislike. Run-off from super phosphate and now, petro chemical fertilisers in ground water entering their world may well cause their demise, as well as the greedy harvesters.

If you study the Toheroa bed position, it is always at the entrance of the groundwater inflow to the beach and never as with other shellfish that get bigger at the hard to get, seaward side of the bed. The drier the weather on land, the deeper the Toheroa are. Whereas in spring, when ground water inflow is strong, they are always shallow in the sand and sometimes right out on top of the beach.

Because of restrictions on Toheroa, my then times fishing mate carted a load of Houhora Tua-tuas from where East Beach meets the Houhora Harbour, to Muriwai, and I helped plant them at suitable spots along the beach, right to the lagoon entrance. I have never seen any of these since that time.

To get back to the Toheroa, I must tell you about the time this same fishing mate and myself were laying on the beach having a rest from fishing, well above the high water mark, when he spotted a Toheroa squirt hole. Or so he said. I laughed away as he dug to get this inland Toheroa. This was in a time of drought and groundwater flows were slow. He dug to about 60cm before he spotted the Toheroa, where there was a good flow of groundwater, and I watched, fascinated to see that the more he dug, the more the hole collapsed and the faster the Toheroa moved. This Toheroa moved faster than any I had ever seen and it finally escaped capture by my mate.

This exercise caused us both to think about this groundwater that didn't come from the sea and many times we would dig for it at the 29 mile mark where sandhills are sparse and the sand between is always damp, flat, and hard enough to drive on. If we could get a bucket of water here, we didn't need to go back to the creek and could prolong our holiday. After rethinking about it, the water dug up was quite horrible.

In later years, after a fairly strenuous plant dig in my nursery, I decided to have a day off and retreated to the sand hills in the winter sun to read a book on my own. It was probably in August 1975. I settled on a sand hill in the clear still weather and commenced reading, with the background sounds of moderate surf. It was glorious. After about half an hour reading, I suddenly noticed a Toheroa on the top of the sand hill lying on its side, beside me with its shell one quarter open. I quickly got up and looked around, no-one anywhere - no birds around, no practical jokers. I got down to eyeball the Toheroa and it looked in good condition, no smell, fresh as a daisy, when suddenly it started convulsing in a vigorous manner. Open, shut, open, shut, rocking around the sand as it did so, and this carried on for quite some time. I thought to myself what have I come across here, so I got down to inspect it more - to eyeball the Toheroa. I couldn't detect anything except a very healthy pulsating opening and shutting Toheroa. I stood up to look around for birds, witnesses anything, but there was nobody, just a peaceful, glorious, clear still day with winter sun on the sandhill and the background sound of moderate surf. As I looked back at the Toheroa, I noticed it wasn't there. "What!" it had disappeared. The area had been fairly well disturbed by this time and I could not make any sense of the marking on the sand. I thought I had better keep this one to myself, you don't know what other people might think.

I would have, except that when I returned home, I was washing my hands over a stainless steel tub ,and I noticed in the mirror, white specks in my dark beard. I gave them a bit of a rub and to my surprise the sand that fell from my beard was not sand, but baby Toheroas, 1mm - 2mm in size. I wouldn't have noticed except when they fell 900mm to the tub bottom, they rebounded back up 450mm.

Now, in my retirement years, I still marvel that very little of the Toheroa is seen in the news, and what a rich food source it would be if we could only grow them. While walking on Muriwai Beach in December 2012 I did observe small Toheroa 10mm to 5mm size in groups of about 50 to a 6 square meter area. They did not appear on the beach until the retreating wave sweep diminished to about 5mm depth, when they would suddenly appear in unison to filter the plankton rich water, only to disappear again in unison as the water flow ceased. Sometimes when the diminishing wave of moderate force reached 150mm to 50mm depth, they would push themselves from the sand in unison and travel with the water flow to a new position on the beach, and again in unison pull themselves beneath the sand.

After talking to a fisherman at the beach about this, he said he had witnessed Toheroa of a larger size moving with the water flow to change location in unison, but had not ever seen Toheroas 10mm to 5mm before. I tell you, they're there alright but certain rules must be obeyed to observe them. The Toheroa observed this day did not appear on cue. If I stood in the water that flowed in their direction, they seemed to know that I was there. If I stood in water flowing away from them, they didn't mind, but if one Toheroa was touched, the immediate surrounding Toheroas would disappear.

When they disappeared, it was not just under the sand. They headed for 30mm at least and could achieve that in 3 seconds. If however, I could flick a Toheroa from its tongue-hold, it would remain dead still on the beach surface just like some worms do.

As adult Toheroa are always found at the point of ground water inflow from beneath the sand, it must surely be important to them to be able to adjust their position on the beach to survive. These small Toheroa were today mostly at the ground water inflow point, but quite a few groups were well above that point, almost half way to the high water mark.

Interesting stuff isn't it? Well, for me anyway. I'm not qualified at anything, but by writing this I am hoping to improve the Toheroa survival rate.

THE EGG CASES, PROTOCONCHS AND EARLY WHORLS OF *NERITA MELANOTRAGUS* E.A. SMITH, 1884

Margaret S. Morley

Nerita melanotragus attaches large numbers of individual white egg cases on high tidal rocks especially around pools (pers. obs.). They are deposited between November and January, hatch after three weeks, and larvae settle between May and July. The veliger lives in the plankton for 5-6 months, and the lifespan of an individual is up to 5 years (Waters et al., 2005).

During a marine survey with Bruce Hayward at Cudlip Point at the south head of Mahurangi Harbour on 22 July 2005, two specimens of *Nerita* less than 2 mm were found in shell sand. These were puzzling because they were pale with a checker board pattern (Fig. 1). I searched for other likely *Nerita* species and wondered if they could be introduced e.g. *Nerita undata*, which is abundant in the Pacific (Abbott & Dance, 1982).

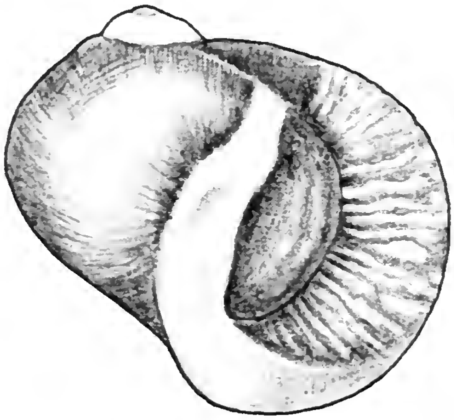


Fig. 1. *Nerita melanotragus* juvenile from Cudlip Point. Width 1.7 mm.

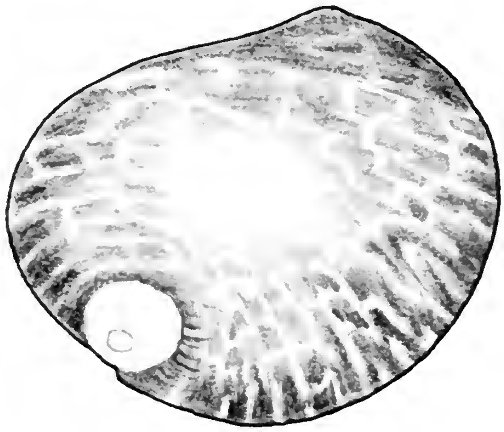


Fig. 2. *Nerita melanotragus* juvenile from Opahi Beach. Width 1.9 mm.

Being keen to find the answer I again visited Cudlip Point and nearby Opahi Beach on 4 August 2005 and examined some hundreds of living *N. melanotragus* on both rocky platforms on the unlikely chance that there were pale adult specimens present. When this drew a blank I searched for eggs or juveniles. Most of the juveniles were already eroded to white at the tip of the spire, making it impossible to see the protoconch. Over 20 juveniles measuring 4-6 mm were examined but the pale patterning could not be seen, only the two smooth white whorls of the protoconch in three uneroded specimens. At home I was disappointed not to find any more juvenile *Nerita* specimens in the large bag of shell sand when examined under the microscope.

At this point my luck changed, while at Opahi Beach on the second visit I had taken several clumps of the oyster *Saccostrea cucullata* to see if any were *C. gigas*. Under the microscope I finally fluked a small juvenile *Nerita*, measuring 1.9 mm, tucked into a crevice between the oysters (Fig. 2). The protoconch was still intact, when compared to the previous small specimens it showed that although the speckling varies, all those seen had pale early whorls. These were very thin, so why does this pale, speckled beginning not show on the adult shell? It appears that they are immersed by succeeding whorls as the animal grows its shell, thus becoming rapidly covered over. In most adults all traces of the pale protoconch are eroded away (Fig. 3). Erosion in this species is accelerated by the thinness of the early whorls and because *Nerita melanotragus* generally live high on the shore where they are exposed to rain, freshwater runoff and sun during a large part of the tidal cycle.
So it seems that *Nerita undata* has not arrived in New Zealand - yet.

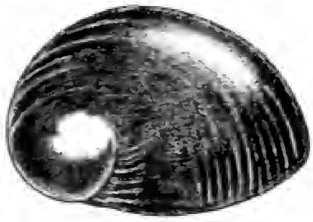


Fig. 3. Adult *Nerita melanotragus* from the Tamaki Estuary. Width 30 mm.

Acknowledgements

Thank you to Ashwaq Sabaa who scanned my drawings and Bruce Hayward who suggested improvements and formatted the article.

References

Abbott, T.R & Dance, S.P. 1982. Compendium of Sea Shells. Dutton Inc. New York, 411 p.
Waters, J.M., King, T.M., O'Loughlin, P.M. & Spencer, H.G. 2005. Phylogeographical disjunction in abundant high-dispersal littoral gastropods. *Molecular Ecology* 14: 2789-2802.

THE JOKE THAT BACKFIRED

Margaret Morley and Bruce Hayward

In the last issue of *Poirieria* (p. 13) there was a story of a joke played by Baden Powell on Marjorie Mestayer, curator of molluscs at the Dominion Museum. A more plausible version has since been given by Hamish Spencer and verified by Richard Willan. They heard Baden tell the anecdote himself at the 50th anniversary of our Club.

He sent a new shell-shaped pasta to Marjorie and told her they were *Ovula spagettii* but he did not hear back. Sometime later he was visiting the Dominion Museum and was amused to see these on display, complete with name. A more careful reading however, made him realise with horror that the joke was on him: the last line on the label read "*Donated by A.W.B. Powell*"!

Thanks to Hamish and Richard for bringing this more accurate version to our notice.

Reference

Hayward, B.W. and Morley, M.S., 2011. Marjorie Mestayer (1880-1955) and her molluscan studies and collections. Poirieria, 36: 13-19.

TRIP TO EAST DIAMOND ISLET, CORAL SEA, NOV/2012

Heather Smith

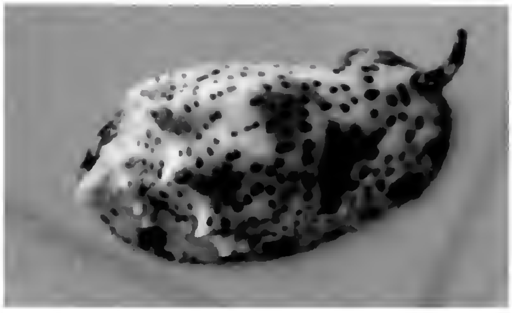
East Diamond Islet is a very small, beautiful island east of Cairns, beyond the Great Barrier Reef in the Coral Sea. Our party included sixteen Australians, one Canadian and myself from New Zealand. We boarded the Eastern Voyager in Gladstone and headed out on 10th November 2012 for an amazing shelling trip. Cheryl Myers and Sally Johnsen from the Brisbane Shell Club organised the trip. Chris Pike the owner of the boat, Danny our Skipper, Jason and Nathan were our four crew members. Previous trips for me, with this group, have been to Frederick Reef 2008, Gould Reef 2010 and the outer Swain Reefs 2011.

For the first time Eastern Voyager and sister ship Tura were moored at their own pontoon in Gladstone making boarding and disembarking in any tide far easier than the previous trips from Gladstone wharf!

Saturday 10th November: Ed Frazer, Robert Ellis, Cheryl Myers and I left Brisbane early for the five hour drive to Gladstone. By 4.15pm we had all loaded our gear on the Eastern Voyager and were heading out from Gladstone Harbour via the North Entrance. Strong easterly winds were forecast for the next day! The original plan was to go to the Swain Reefs, and from there across the Coral Sea to East Diamond but instead it was decided to go north inside the Great Barrier Reef, spending some time at reefs approaching Hydrographer's Passage east of Townsville, and when the winds abated, pass through the Passage out to the Coral Sea. This would give us a much shorter distance across the open Coral Sea. (See map) As we headed north the south-easterly winds grew stronger and the sea more boisterous until we reach our first destination Paul Reef.

Sunday 11th: At 3.00pm as we approached our anchorage the hull of our boat bounced lightly over a bommie! The owner Chris assured us that the boat had come off better than the bommie! (A bommie is a very large clump of coral) The wind was too strong for five dinghies to be launched here, but the seven divers were able to go in from the tail board of the Eastern Voyager. Visibility was poor and little of interest was found.

Monday 12th: At 5.20am we weighed anchor and left St Paul heading for Chauvel Reef arriving just in time for lunch. Two dredging dinghies and one dinghy with divers set out in strong winds. Dredging was not comfortable in these conditions and it was agreed that we all deserved a "Lunatic Certificate"! However some nice shells were collected including Terebras, Bivalves, Strombs and Olives. But the real find were two *Cymbiola (Cymbiolacca) pulchra peristicta*, one dredged and the other found by a diver. These shells rarely occur as far north as Chauvel Reef. Passengers with beds in cabins right up against the engine room heard the anchor hauling in as the engines started at midnight!



Tuesday 13th: We travelled north through choppy seas to Bugatti Reef dropping anchor around 9.50am. This reef lies on the South side of Hydrographer Passage. The lighthouse beacons which mark the passage were visible in the distance and we occasional saw ships passing through the passage. Despite strong wind, dinghies set out with dredging parties, divers and fishing parties. We stayed the night here.

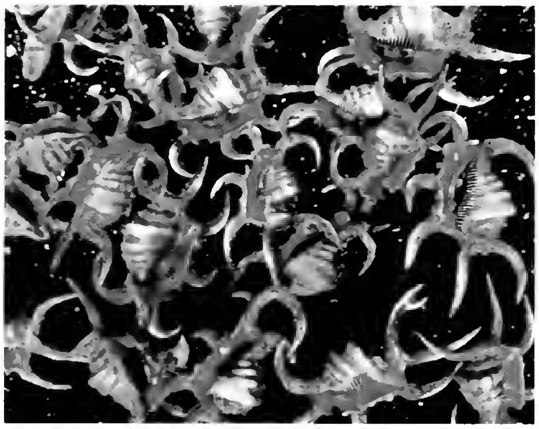
Wednesday 14th: We were all on deck at 6.00am to watch the eclipse. Some of the sun was obscured as the moon travelled between our planet and the sun. The light was slightly dimmed! It certainly was a sight to remember! We dredged again. Over two days of collecting here the dominant species were *Terebra: maculata, subulata* and the lovely orange *guttata*, *Oliva miniacea*, two *Malea pomum* and a sundial *Architectonica perspectiva*. But by far the most interesting find was the golden form of *Volutidae amoria maculata*. Some were found live and some hermit crabbed. By 11.45am we were on our way. The crew warned us that as we travelled through Hydrographer Passage we may encounter some rough sea! They were right! Most of us had moved to the back deck as we watched wave after wave come crashing down over the top deck and slosh down the sides on our deck. For ten to fifteen minutes we held our breath and hung on! Nobody suggested putting on life jackets! Eventually the sea levelled out and our skipper appeared. He did say his heart rate was returning to normal and that he had been either been holding his breath or swearing as we rode the big waves! Apparently the tide was heading in one direction and the wind in the other. As our little ship climbed to the top of one wave and dropped over it, the next wave struck over top of us! Once into the Coral Sea there was a large swell but not the short huge waves of the passage. We realised what great control over the boat the crew actually had when they heard Julie and Robyn chatting on the side deck below. The skipper turned the boat slightly starboard a couple of times to splash the pair and then he turned the boat much more and the biggest wave splashed over drenching them both! Some of the keen fishermen had lines over the side and when a large fish was hooked somebody would run forward on our deck and bang loudly on a side panel. The skipper above would bring the boat to a grinding halt! The boat wallowed in the swell while we all watched the fish being hauled on board.

Thursday 15th: Around lunch time we saw the very welcomed sight of East Diamond Islet. After six days of traveling we were all eager to put our feet on dry land. The anchor was dropped in calm water and we marvelled at the white sand, clear blue water and the prolific bird life. The dinghies were launched. On landing it was difficult deciding what to do first. It took 45 minutes to walk around the island collecting dead

shells from the high tide water line and watching many orange hermit crabbed shells scuttling up and down the beach. Some of the hermit crabs were wearing holes in their old shells and three hermit crabs had chosen new 'apartments' in plastic lids for their homes. (It's possible that Cyclone Yasi Feb/2011 washed many shells ashore and the crabs took advantage of this but now their shells are all occupied and wearing out!) The bird life was abundant! Red Footed Boobies with chicks and Lesser Frigate Birds with chicks roosted in low scrub around the edge of the island. Brown Boobies and Masked Boobies nestled on the sand protecting eggs and chicks. All these large birds were not afraid of humans and it was possible to get very close for photographs. Brown and Black Noddy Turns and many Sooty Terns all with eggs or chicks were nesting on the ground in scrub further in. Some very small tern chicks were trying to protect themselves from the sun by crouching up close to pieces of coral on the sand spit at one end of the island. They were incredibly camouflaged and one had to be careful not to stand on them. The purpose for our visit was to look for the legendary Volute *Cymbiola (Cymbiolacca) perplicata*. This shell was named in 1902 but the locality where it was collected was unknown until Tom Nielson in 1974 discovered its habitat on islands in the Coral Sea. Two dredging dinghies went to work. One boat brought up a live adult *perplicata* and the second dredge crew brought up a juvenile which was quickly returned to the water. When the divers went down in the evening a second live adult was collected. But these were the only live specimens found. During our stay a few dead specimens were collected on the island. Overall dredging on East Diamond Islet was a little disappointing as none of the expected *Strombus vomer* or the white form of *Harpa major* were dredged. Most dredging runs returned with only rubble, and no shells at all. The divers found two large specimens of *Oliva sericea* and some *Lambis chiragra*. The snorkelers produced perhaps the best results with more *Lambis chiragra*, *Lambis truncata* and *Oliva annulata*. Advantage was taken of the exceptional low tides on both mornings, so collecting expeditions went ashore in the dark and with torches walked to the far side of the island to locate *Cypraea mauritiana*. How amazing to shine your torch under a slab of old coral, on the low tide water line and see these creatures often hanging upside down like limpets attached to the underside of the flat coral slabs.

Friday 16th: Sally and I climbed the lighthouse tower to view the island from a different perspective. The little

island lay below, the crystal clear blue water stretched in every direction as far as the eye could see and our little ship the only form of human existence in sight. The Noddy Terns and the Sooty Terns wheeled and screeched around us while the chicks on the ground called to the adults. We had a final snorkel and with the help of Jason our boatman we spotted many *Lambis chiagra* and *truncata* in about eight metres of water. We pointed them out and young Jason free-dived down and retrieved them. On the far side of the island plastic rubbish in the form of bottles, jandals, pegs and a variety of odd flotsam and jetsam lay above the high tide line. Chris provided rubbish bags and I spent the afternoon filling 3 of them. Jason and Sally helped get these back to the Eastern Voyager. In the evening the divers had a final dive under the boat collecting a small number of shells including a *Conus floccatus*. We all wanted to spend more time here at East Diamond but by 8.50pm it was time to weigh anchor and head south across the Coral Sea towards Swain Reefs.



Saturday 18th and Sunday 19th: These days were bright and sunny, with little wind and no swell providing remarkably comfortable travel in the open sea.

Monday 19th: At 5.02am we dropped anchor in Perfect Lagoon. Dredging and fishing parties set out soon after. Two specimens of *Cymbiola (Cymbiolacca) peristricta* were dredged and a number of specimens of *Amoria maculata*, *Murex queenslandicus*, *Malea pomum* and *Oliva miniacea*. The divers dived under the boat and obtained a few *Murex queenslandicus*. Once again both dredging and diving produced less than we had anticipated.

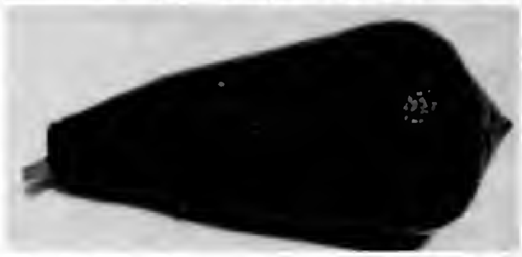
Tuesday 20th: With another low tide, expeditions set out for a small rubble cay and obtained typical reef shells with some good finds. Snorkelling conditions were perfect. It was possible to swim on the surface and stretch down to turn over coral slabs revealing a variety of cones. I picked up two *Conus crocatus* and had happily given the smaller one away before I was told that they were an extremely rare find in Australia! *Conus aureus*, *episcopalis, magnificus* and a lovely dark *tulipa* were all found. The rubble bank which forms during hurricanes is starting to be colonised by *Murex penchinati*. Colourful red and black striped sea urchins were also found on the rubble bank. One large dead and three smaller *Melo amphora* were also located. John Patchett was thrilled with his *Cypraea cicercula* found while diving.

Wednesday 21st: At 5.20am we left Perfect Lagoon and sailed south through the Capricorn Channel towards Gladstone.

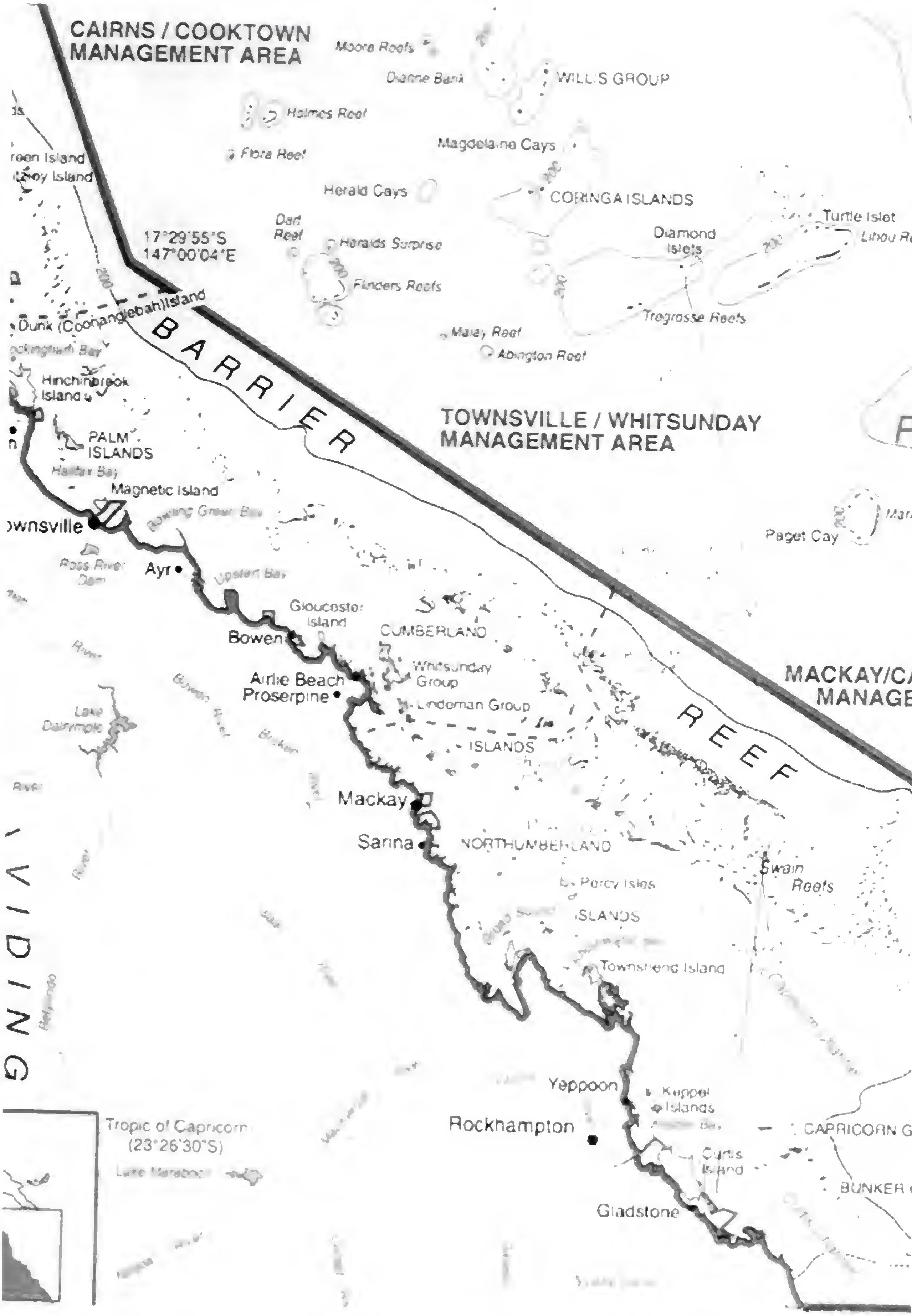
Thursday 22nd: At 3.50am we were back at the new pontoon in Gladstone. After an amazing twelve days on board the Eastern Voyager our ship mates said their final farewells. Although we didn't locate *Cymbiolacca* volutes as we had anticipated both on East Diamond Islet and in Perfect Lagoon everyone was happy with their finds and their experiences on East Diamond Island.

A big thank you to all those who helped make it such a successful trip.

In the Queensland Radula Nov/2011, an account noted that the population of *peristicta* volutes at Perfect Lagoon in the Sept/2011 trip was very much less than on a previous visit in Oct/2008. It was suggested that this was due in large part to tropical cyclone Hamish that had passed over the Lagoon early in 2009. On our present trip with only two *peristicta* found their population is barely recovering. Likewise the *perplicata* volute population on East Diamond Island was very small compared with reports of expeditions there in the 1990's and early years of this century. The very severe Cyclone Yasi passed directly over East Diamond Island in Feb/2011. It is likely the population depletion is related to the hurricane damage. *Cymbiolacca* live in shallow sand. They reproduce relatively slowly, and the young hatch crawling directly from the egg, with no free-swimming veliger stage. So if a severe hurricane depletes a local population, there are no replacement individuals entering the area from outside. On East Diamond Island, it appears that some species such as *Lambis truncata*, *Lambis chiragra* and *Oliva minacea* had recovering populations, but there was an absence of some species other than volutes formerly well known from the locality such as *Strombus vomer* and the white form of *Harpa major*. Areas that were dredged, where we thought we would locate these species, were actually barren of any live shells. Both at Perfect Lagoon and East Diamond Island there was evidence of massive damage to coral.



References and thanks to Trevor Appleton for his article "*Collecting Trip to East Diamond Islet in the Coral Sea Nov/2012*" Radula (Brisbane Shell Club Newsletter) and to Lorraine Rutherford for her article "*Our last Trip to the Coral Sea*" in Keppel Bay Tidings Nov/2012.


CAIRNS / COOKTOWN
MANAGEMENT AREA
Moore Reefs
Dianne Bank
WILLIS GROUP
Holmes Reef
Flora Reef
Magdelaine Cays
Herald Cays
CORINGA ISLANDS
Turtle Islet
Lihou Ree
Diamond
Islets
17°29'55"S
147°00'04"E
Dart
Reef
Heralds Surprise
Flinders Reefs
Tregrosse Reefs
Dunk (Coonanglebah) Island
Malay Reef
Abington Reef
BARRIER
Hinchinbrook
Island
TOWNSVILLE / WHITSUNDAY
MANAGEMENT AREA
PALM
ISLANDS
Magnetic Island
Townsville
Paget Cay
Ayr
Gloucester
Island
CUMBERLAND
Bowen
Whitsunday
Group
MACKAY/CA
MANAGE
Airlie Beach
Proserpine
Lindeman Group
Lake
Dalrymple
ISLANDS
REEF
Mackay
Sarina
NORTHUMBERLAND
Swain
Reefs
Percy Isles
ISLANDS
Townshend Island
DIVIDING
Yeppoon
Keppel
Islands
Rockhampton
Tropic of Capricorn
(23°26'30"S)
CAPRICORN G
Curtis
Island
BUNKER
Gladstone